JOHNSON
COMPUTER (216) 725-4560

PRELIMINARY INFORMATION ON MICROSOFT 8K BASIC FOR KIM-1

Variable names must start with an alphabetic character,eg. A, A1, A(3,7,2), ZULU
String (literal) variable. names are followed by a dollar sign,eg. A$, ZULU$, A$(2,3)
Although variable names may consist of more than two characters, only the first two characters uniquely identify the varable,eg. COST is the same as CORE

OPERATORS: -, +, *, /, ↑, *NOT*, *AND*, *OR*, >, <, <>, <=, =, >=

STATEMENTS	FUNCTIONS	STRING FUNCTIONS	COMMANDS
CLEAR	ABS(X)	ASC(X$)	CONT
DATA	ATN(X)	CHR$(I)	LIST
DEF	COS(X)	FRE(X$)	NEW
DIM	EXP(X)	LEFT$(X$)	NULL
END	FRE(X)	LEN(X$)	RUN
FOR	INT(X)	MID$(X$,I,J)	
GOTO	LOG(X)	RIGHT$(X$,I)	
GOSUB	PEEK(X)	STR$(X)	
IF...GOTO	POS(I)	VAL(X$)	
IF...THEN	RND(X)		
INPUT	SGN(X)		
LET	SIN(X)		
NEXT	SPC(I)		
ON...GOTO	SQR(X)		
ON...GOSUB	TAB(I)		
POKE	TAN(X)		
PRINT or ?	USR(1)		
READ			
REM			
RESTORE			
RETURN			
STOP			

@ Erase typed line
SHIFT/O or ← Erase last character
: Seperates statements on same line
CONTROL/C Interrupts execution or listing
CONTROL/O Inhibits output to terminal

Both versions of BASIC use page zero and page one. They start at 2000HEX. Although they are meant to be used with serial terminals, I/O pointer locations are provided. The USER, PEEK, POKE, and WAIT statements are used to link BASIC to machine code programs and the KIM-1 ports. The 6 digit version uses two-letter symbols for error messages. The nine digit version spells out complete error messages. When executions or listings are interrupted by means of the CONTROL/C or an error, BASIC indicates the number of the line it was about to execute or list.

CAT #	PRECISION	LOADS AT	# OF BYTES	MIN. SYSTEM RAM	RANGE	PRICE
KB-6	6 DIGITS	2000HEX	8257	12000	10E-32 to 10E+32	97.50*
KB-9	9 DIGITS	2000HEX	8802	12000	10E-32 to 10E+32	129.00*

*TERMS: PAYMENT WITH ORDER. ADD $4.00 FOR SHIPPING AND HANDLING. OHIO RESIDENTS ADD 4.5% SALES TAX ($4.39 for KB-6 and $5.81 for KB-9)

Microsoft 8K BASIC for the KIM-1 is furnished on cassette with complete documentation, including a 239 page Schaum's Outline Series' Theory and Problems of Programming with BASIC by Byron S. Gottfried, Ph.D., McGraw Hill.

P. O. BOX 523 MEDINA, OHIO 44256

#17 8

MIDNIGHT RIDE · ONE IF BY LAND TWO IF BY SEA
USA 24c

ELPHIA, PA
19

WILLIAM SCHOFIELD
1701 HAMILTON LANE
TEANECK, NJ 07666

KIM-1/6502 USER NOTES
℅ ERIC C. REHNKE
109 CENTRE AVE
W. NORRITON, PA. 19401
U.S.A.

FIRST CLASS

SEPT & NOV 1977 KIM-1/6502 USER NOTES ISSUES 7 & 8

We're beginning to feel like nomads here at the USER NOTES! As you can see from the new return address we've moved again. I'd like to thank you for your patience. I've decided to make this a double issue to help make up for the delay. Hope you notice our new mailing labels. KIM is now doing a little work for the newsletter (it's only fitting, right?). See the "SOFTWARE REVIEW" for mor info on this godsend of a software package.

****

ATTENTION NEW SUBSCRIBERS!!!!!!!!

Unfortunately, we are completely sold out of back issues to the newsletter. If you signed up for issues 1 thru 6 you are automatically being set up for issues 7 thru 12 instead. Plans for reprinting have not been finalized. As soon as things are nailed down as far as price and availability are concerned, that info will be passed along in the NOTES.

****

57109 CALCULATOR CHIP AVAILABILITY

In the last issue of USER NOTES, the new RPN calc. chip from NATIONAL was mentioned as a idea for a KIM interface. It is advertised as being available from TRI-TEK INC., 6522 N 43rd Ave., Glendale, Az 85301.

The price quoted is $21.92 for the chip and data sheets or $2.00 for the data sheets alone.

****

FROM THE FACTORY AVAILABILITY OF MEMORY & MOTHERBOARDS

As you know, the KIM-2 and 3 (4K and 8K RAM cards) have been discontinued. The KIM-4 Motherboard is back on the production list and should be available in December. The KIM-3A, long awaited 8K replacement board, will be delayed indefinately.

~~However, don't despair!!! It is possible to adapt boards of the S-100 genre to the KIM-4 motherboard. In fact, an application note describing one particular is available from MOS TECHNOLOGY. This app. note describes~~

However, don't despair!!! It is possible to adapt boards of the S-100 genre to the KIM-4 motherboard. In fact, an application note describing one such adaptation is available from MOS TECHNOLOGY. This app. note describes the mechanical and electrical interface necessary to add a KENT-MOORE ALPHA-VIDEO or their 4K RAM board to the motherboard. These two particular S-100 boards are fully assembled and tested and worked well.

Other S-100 boards could also be adapted, but due to the wide variance of signal requirements necessary for the seemingly "standard" bus structure, all other adaptations are left up to the cleverness of the user.

****

KIM-1 USER NOTES are published bi-monthly by Eric C. Rehnke, 109 Centre Avenue, W. Norriton, Pa. 19401. Subscription rates are $5.00 for six issues (U.S. & Canada)..$10.00 for six issues elsewhere. No part of the USER NOTES may be copied for commercial purpose without the expressed written permission of the publisher. Articles herein may be reprinted by hobby or club newsletters as long as proper credit is given and the publisher is provided with a copy of the publication.

SOFTWARE REVIEW by the editor

.............Get "HELP" from the COMPUTERIST......

HELP is a series of application programs which include a mailing list handler, a text editor and printing package, and an information retrieval program, which run on the naked KIM. I used the mailing list package. All I added was another cassette, a couple of TTL-controlled relays, and, of course, a hard-copy terminal (which is needed for all three packages). But, come to think of it, you could probably get away with using one of the low cost impact printers out on the market.

Anyway, the software is really excellent. "HELP" is actually an interpreter-style parameter-passing language which is very well documented and worth every penny of the $15.00 price just to see how it works! It would seem fairly straightforward to adapt this style of mini-interpreter to about any kind of application, such as; data collection, text editing, word processing, game playing, disc-file management, etc.

All sorts of neat things can be done with a little imagination!!

"HELP" REALLY IS IMPRESSIVE!!!!!!!!!Seeing KIM doing some useful work for the newsletter is a thrill that just can't be described!!!

I highly recommend that you get more info on the "HELP" mailing list package as well as the rest of the "HELP" packages. Each are $15.00.

For the latest information, write: The COMPUTERIST, PO Box 3
S. Chelmsford, Ma 08124

P.S. Ask for their complete catalog and a copy of their simplified 6502 op-code table.

****

6502 vs. Z80

Want to know which chip comes out on top? Then get a copy of KILOBAUD #10. Turn to page 20 and read the article.

Z80 Freaks---eat you hearts out !!!

****

...GOOD GUYS REALLY COME THROUGH !!!

In issue #6, I asked for volunteers who would be willing to help out other members of the group by answering questions etc. through the mail. Here are the first of the "good guys" DON'T FORGET TO SEND A SELF-ADDRESSED-STAMPED-ENVELOPE with your correspondence so our friends don't go broke.

Bruce Davidson, Box 1738, Bismark, ND 58501

Mike Jerabek, c/o University of New Hampshire, Physics Dept., Demeritt Hall,
Durham, N.H. 03824 (SOFTWARE)

Stan Bowling, 828 N. 31St., Colorado Springs, Colo. 80904 (HARDWARE & SOFTWARE)

Alan Jorgensen, 14007 N. 35th Drive, Phoenix, Arizona 85023

John Fallisgaard, Apt. #604, 1101 S. W. Pkwy., College Station, Tx. 77840
(HARDWARE & SOFTWARE)

Thomas Bray, Apt. #5, 1945 N. Oakland Ave, Milwaukee, Wisc. 53202

If your looking for a bit of fame (not much fortune) then add your name to our growing list of "GOOD GUYS".

Eric.....

****

Philip A. Wasson
9513 Hindry Pl.
Los Angeles, CA 90045

TRACE

With this program and about $2.00 worth of hardware you can see displayed on an oscilloscope screen, all the registers in the 6502 and three consecutive memory location starting at the address contained in the registers. They are displayed in the following format:

```
  PC XXXX XX XX XX
  SP 01XX XX XX XX
     XXXX XX XX XX
  NV bdIZC X  Y  A
  xxxxxxxxXX XX XX
```

The first line shows the label PC, indicating the program counter, followed by the the address contained in the PC, followed by the contents of three consecutive address, starting at the value of the PC.
The second line shows the stack pointer in the same format.
The third line shows a user definable address and displays it in the same format as above.
The fourth line shows labels for the bits of the P register and for the X, Y, and A registers.
The last line shows the contents of the registers.

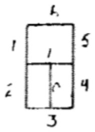
The program consists of a software driven graphics generator, a display formatter, and a monitor. It resides in $0200-$03FF.

MEMORY ALLOCATION:

03EB-03FE	SEGMENT FORMAT TABLE
03E0-03EA	CHARACTER FORMAT TABLE
03B1-03DF	LINE FORMAT ROUTINE
03A9-03B0	PATCH AREA
0360-03A8	DISPLAY ROUTINES
0303-035F	DSPREG
0270-0302	MONITOR
022B-026F	HEADING TABLE
021B-022A	EXIT ROUTINE
020D-021A	PATCH AREA
0200-020C	INITIALIZATION OF NMI VECTOR

Here are the locations of several useful subroutines:

0303 DSPREG - Displays all registers.
0360 OUTBYT - Displays a byte in A.
036B OUTCHR - Displays a symbol if bit 7 of the accumulator is off. Symbols displayed are: 0,1,2,3,4,5,6,7,8,9,0, A,b,C,d,E,F,o,i,P,B in order of the numeric value of the five low order bits of the accumulator.
If bit 7 is on, a vector is drawn in one of fifteen direction, depending on the value of the low order bits. Bit 0 is used for beam blanking. Bits 1 and 2 along with bits 3 and 4 indicate the new relative vertical and horizontal position, respectively. Bits 5 and 6 are vertical and horizontal reset, respectively.
0374 OTSEGS - Displays a symbol in the following 8 segment display format, with the bits in the accumulator indicating the corresponding segments to be displayed.



038B NEWLN - Returns beam to left margin and down one lin
038F NEWPG - Returns beam to top left margin.

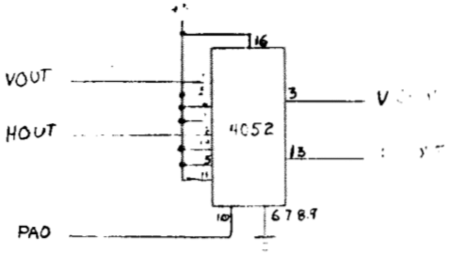
$1701 MUST BE SET TO $FF BEFORE CALLING THESE ROUTINES!

CONSTRUCTION AND USE

Construction layout of the oscilloscope driver circuitry is not critical, but leads should be kept as short as possible. It is important that the power supply be well regulated for a stable display. A 309 or 7805 type regulator is adequate.

Some users may want to use a CMOS 4555 instead of the TTL logic.

If your oscilloscope does not have a Z axis input, the following circuit is suggested. This circuit deflects the beam off the screen during the blanking period.



To use the program, connect A-15 to E-6 on the KIM connectors and begin execution at $0200. This sets the NMI vector to $0270. Now, when you press the ST key, you will be in the TRACE monitor. This monitor is just like the KIM except it is always in single step mode (even though the SST switch is off!) and when AD is pressed, it is put in address mode and the address is decremented by one. To return to the KIM, press RS.

Set $ED and $EF to the address you want to monitor. This address and it's contents will then be displayed continuously on the third line of the display.

Set your oscilloscope to x-y input mode and the horizontal and vertical attenuators to about .2V/cm DC. Connect the x, Y, and Z inputs to the driver circuit. Adjust the beam intensity for optimum character definition.

You will notice that the KIM display is dimmer than usual and there is some flicker of the displays, about 16 frames per second. Also the display on the scope may be slanted. To correct this, adjust the 50K trim pots for horizontal lines and vertical margins.

If the scope display appears to be written in hieroglyphics, the beam blanking may need to be inverted. To do this, set $039C to $01.

MODIFICATIONS

The trick to single step operation without using the SST switch is in the interupt exit routine. This routine sets the timer to give an NMI one clock cycle after the RTI is completed. This is part way into the next instruction to be executed. Since all instructions take at least 2 cycles, and the interupt is inhibited until the instruction is complete, only one instruction is executed before the NMI occurs. Thus a single step function is performed.

```
21B AD 03 17 INTEX LDA PBDD
21E 29 7F          AND #$7F
220 8D 03 17       STA PBDD
223 A9 28          LDA #$28
225 8D 0C 17       STA CLK1TI
228 4C C8 1D       JMP GOEXEC
```

more...

TRACE (contd)

In behuring large programs with many loops it is desirable to use conditional tracing. To do this, the user must write a routine to test the desired conditions to be traced. Locations $0287 and $0288 are set to the address of the test routine (low order byte first, of course). If the condition is met, the test routine exits with a JMP $1F88 (INITS). Otherwise, exit with:

```
          PLA
          PLA
          JMP $021B
```

EXAMPLE: Trace if X is less than 2 OR A=0.

```
TEST    LDA $F5    GET VALUE OF X
        CMP =2
        BCC TRUE   SINGLE STEP IF X IS LESS THAN 2
        LDA $F3    GET VALUE OF ACCUMULATOR
        CMP =0
        BEQ TRUE   SST IF A=0
FALSE   PLA
        PLA
        JMP $021B EXECUTE NEXT INSTRUCTION
TRUE    JMP $1E88 RETURN TO TRACE MONITOR
```

IF YOU ARE USING CONDITIONAL TRACING, IT IS NECESSARY TO ENTER THE <u>TRACE</u> MONITOR AT $0289, INSTEAD OF BY THE <u>ST</u> KEY!

EXAMPLE: Press RS, AD, 0, 2, 8, 9, GO
Now set address where tracing is to begin and press GO.
To return to normal tracing, set $0287 to $88 and $0288 to $1E.

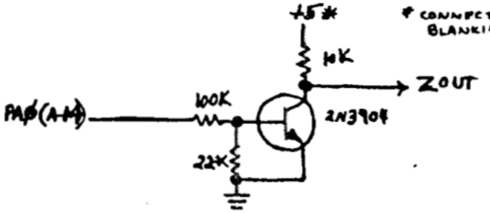
The following routine executes a program in "slow motion", about one instruction per second, and displays all the registers on the oscilloscope screen.

```
200 A2 11     SLOMO LDX =$11  ;SPEED CONSTANT
202 8E OF 02 LP    STX SAVX+1
205 20 03 03       JSR DSPREG
208 20 6A 1F       JSR GETKEY
20B AA             TAX        ;SET FLAGS IN P REG
20C F0 0A          BEQ TOMON
20E A2 00     SAVX  LDX =*-*
210 CA             DEX
211 D0 EF          BNE LP
213 68             PLA
214 68             PLA
215 4C 1B 02       JMP $021B ;TO EXECUTE ONE INSTRUCTION
218 4C 88 1E TOMON JMP $1E88 ;RETURN TO TRACE MONITOR
```

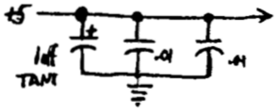
To start SLOMO, set $0287 to $00 and $0288 to $02 with KIM . Enter TRACE monitor by starting execution at $0289. Then set address where tracing is to begin and press GO.

To return to TRACE monitor, press 0 key.

To resume SLOMO, press GO.



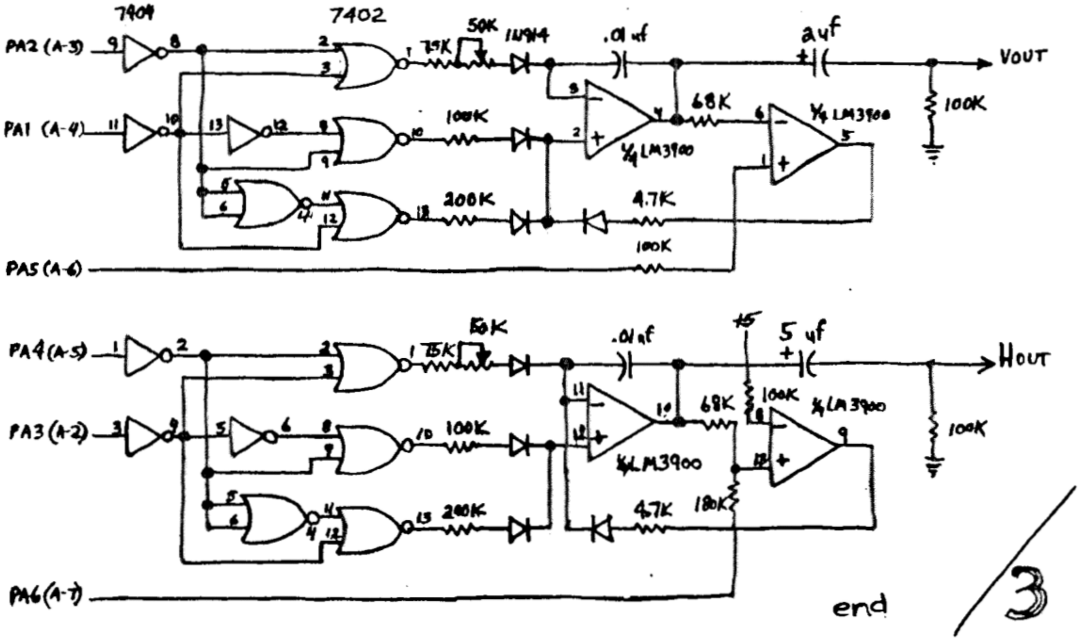
* CONNECT TO +12 IF MORE BLANKING IS NECESSARY.



ALL RESISTORS 1/4W

HEX DUMP OF "TRACE"

```
ADDR   0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F
0200  A9 70 8D FA 17 A9 02 8D FB 17 4C 89 02 00 00 00
0210  00 00 00 00 00 00 00 00 00 00 00 AD 03 17 29 7F
0220  8D 03 17 A9 28 8D 0C 17 4C C8 1D 12 0C 13 05 12
0230  13 13 13 13 86 85 85 8F 8F 85 85 86 88 84 87 87
0240  8D 8D 86 88 13 0B 0D 84 91 98 88 87 87 88 93 91
0250  84 88 91 86 99 8D 8D 99 96 88 0C 13 84 8F 8F 98
0260  8D 8D 86 88 13 13 84 8F 86 85 8D 86 88 13 13 0A
0270  85 F3 68 85 F1 68 85 EF 85 FA 68 85 F0 85 FB 84
0280  F4 86 F5 BA 86 F2 20 88 1E 20 8C 1E 20 03 03 20
0290  19 1F D0 F5 20 03 03 20 19 1F F0 F8 20 19 1F F0
02A0  F3 20 6A 1F C9 15 10 E1 C9 14 F0 4C C9 10 F0 2C
02B0  C9 11 F0 34 C9 12 F0 37 C9 13 F0 39 0A 0A 0A 0A
02C0  85 FC A2 04 A4 FF D0 0A B1 FA 06 FC 2A 91 FA 4C
02D0  D7 02 0A 26 FA 26 FB CA D0 EA F0 10 A5 FA D0 02
02E0  C6 FB C6 FA A9 01 D0 02 A9 00 85 FF 4C 89 02 20
02F0  63 1F 4C 89 02 4C 1B 02 A5 EF 85 FA A5 F0 85 FB
0300  4C E4 02 20 8F 03 A9 FF 8D 01 17 A2 00 A5 EF 85
0310  F6 A5 F0 85 F7 20 B1 03 A5 F2 85 F6 A9 01 85 F7
0320  20 B1 03 A5 ED 85 F6 A5 EE 85 F7 20 B1 03 A0 3C
0330  BD 2B 02 20 6B 03 E8 88 D0 F6 20 8B 03 A5 F1 A0
0340  08 2A 48 A9 10 90 02 A9 11 20 6B 03 68 88 D0 F1
0350  A2 03 B5 F2 20 60 03 A9 13 20 6B 03 CA D0 F3 60
0360  48 4A 4A 4A 4A 20 6B 03 68 29 0F 30 2A 8E 89 03
0370  AA BD EB 03 8D FF 03 A2 0B BD DF 03 30 04 2E FF
0380  03 2A 20 97 03 CA D0 F1 A2 03 60 A9 46 D0 02 A9
0390  60 86 FD A2 10 D0 04 86 FD A2 03 49 00 8D 00 17
03A0  CA D0 FD 8E 00 17 A6 FD 60 00 00 00 00 00 00 00
03B0  00 A0 03 BD 2B 02 20 6B 03 E8 88 D0 F6 A5 F7 20
03C0  60 03 A5 F6 20 60 03 8E DE 03 A2 03 A9 13 20 6B
03D0  03 B1 F6 20 60 03 C8 CA D0 F2 20 8B 03 A2 03 60
03E0  90 02 88 9E 08 02 0C 03 03 08 02 FC 30 6E 7A B2
03F0  DA DE 70 FE FA F6 9E CC 3E CE C6 1E 01 E6 00 00
```



end

Pł p A. Wasson
9l Hindry Pl.
Los Angeles, CA 90045

TWO "NEW" INSTRUCTIONS FOR THE 6502

Have you ever wondered if those undefined op codes for the 6502 do anything? Well, there are at least two "new" instruction that I have discovered. First let me warn you that they are undocumented and are subject to change by the manufacturer. Also they are a little strange.

The first is op code 7E which I have given the nmemonic DXE which stands for "Decrement if index register X Equals zero". The only address mode is absolute. The use of the DXE only seems to effect the N flag, which appears to be undefined but depends on the value of X.

The second op code is 9E. I have given it the mnemonic SXNE, which stands for "Set effective address to one if index register X does not equal zero, otherwise set to zero". The only addressing mode is absolute indexed by Y. It does not appear to set any flags.

There also appear to be some redundant op codes, such as, 66=C6, 6A=0A, etc. My search has by no means been exaustive so there may still be some more undiscovered instructions.

The date code on my 6502 is 0676 so it doesn't have the ROR instruction. If the 6502 is microprogrammed later versions may respond differently to these op codes.

Some comments & corrections from - Mike Firth, 104 N. St. Mary, Dallas, TX 75214

Before going to the main point of my letter, I want to say that I have my programming for my Polymorphics Video Board running nicely. It has the built in ability (by changing a flag) to work with 32 or 64 character lines, allowing for the wiring scheme of the Poly board (ie. ignore address line 5 for 32 characters). The programming includes all of the screenread functions, home, line feed, carriage return, blank screen, backspace, forward curser (without changing characters) up and down curser. For my own purposes I will be working on an editor (or adapting HELP which I have bought but not yet received) to permit character editing and writing of the screen to tape and loading from tape to the screen.

I am about to buy the 8K base 2 (advertised in ON_LINE) S-100 board, which is $125 for the slower speed I can use and is by far the cheapest I have seen. Will let you know.

MORE TRIAC

It may be a bit late, but I do have to point out a couple of things about the notes on running a triac from KIM in issues 3 and 4. The original (#3,p.8) works much better if the load is attached to MT2 and the plug or power supply is to MT1 (in other words, exchange the labels at the right of the bottom diagram on page 8.)

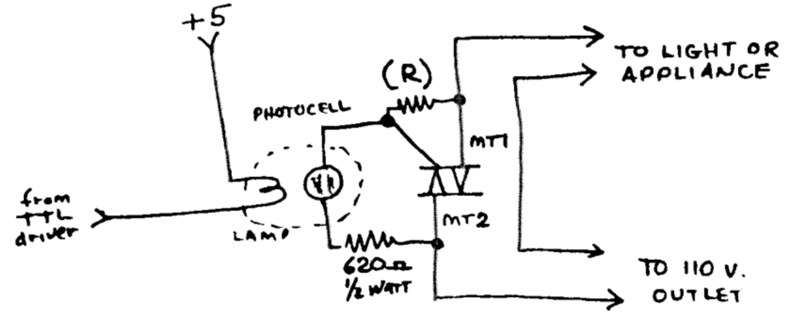
I am somewhat surprised the circuit shown in the diagram in KUN4 (p.6) works at all, for several reasons. First, I believe the resistance connection from the photocell (shown as 10K) should go to MT2 and not beyond the load.

The flicker that is mentioned can come from either of two sources, both of which should make the circuit work poorly. The Radio Shack CdS cells that I purchased (and have used for other projects) have a very slow decay time, on the order of a second. Secondly, making an incandescent lamp respond in something like a single cycle (120 per second) is very unlikely. Therefore, the pulses are modulating the lamp just above and below the trigger brightness needed for the triac. Well, sometimes, due to slight shifts in the characteristics of the lamp and the cell and the triac the trigger signal will either come late in the cycle or just miss for several cycles causing flicker. (Example, lamp heats photo resister, changing resistance, lamp is pulsed less often, unit is cooler, slowly the resistance changes, besides the light effect.) I think examination of the Triac wave forms will show a very sloppy output that may harm some motors. Take care.

MORE ON THE TRIAC FROM: G. THOMPSON, 39 JUDSON ST. ROCHESTER, N.Y

"HERE IS A REVISION ON CASS LEWART'S TRIAC INTERFACE (#3, P. 8) [redacted] THAT IMPROVES SHUT OFF.

IWAS RUNNING A 25W. BULB AND NOTICED THAT SHUT-OFF WAS NOT IMMEDIATE-THE BULB WOULD GLOW AT HALF BRILLIANCE FOR A SECOND OR SO-THEN EXTINGUISH. A SCOPE SHOWED THAT THE TRIAC WAS ACTING LIKE AN SCR DURING THIS DIMMED PERIOD, THAT IS, HALF-WAVE INSTEAD OF FULL. THE SMALL RESISTOR (R) WAS ADDED AFTER STUDYING RADIO SHACKS CIRCUITS FOR DIACS AND TRIACS. IT WORKS ONA 25W. BULB, AN AQUARIUM PUMP , AND A 1/20 HP WATER PUMP!



10 < R < 50Ω depending on load

****

Charles C. Ohsiek
Box 853
Patchogue, NY 11772

This code allows writing an ID on the audio cassette tape prefixing the data SUPERTAPE writes out. This ID can then be shown by VU-TAPE, or ignored by the KIM-1 tape monitor.

The ID consists of one byte, or two hex characters, at address 17F9; these two hex characters MUST BE IDENTICAL; i.e., 11, 77, AA, etc. NOT 01, 07, etc.; otherwise it cannot be viewed properly on LED's. This allows fourteen different ID's before duplicating.

```
Relocatable

(01BF C3 03 7E   END OF  SUPERTAPE)
 01C2 A0 BF      START   LDY    #$BF      Set directional
 01C4 8C 43 17           STY    PBDD      .registers
 01C7 A2 08              LDX    #$08      Send 8
 01C9 A9 16              LDA    #$16      .sync
 01CB 20 61 01           JSR    HIC       ..characters
 01CE A9 2A              LDA    #$2A      Send
 01D0 20 88 01           JSR    OUTCHT    .asterisk
 01D3 AD F9 17           LDA    ID        Setup to send
 01D6 A2 64              LDX    #$64      .100
 01D8 86 E0              STX    TIC       ..ID characters
 01DA 48         LP      PHA              ..save character
 01DB 20 70 01           JSR    OUTBT     ....send it
 01DE 68                 PLA              .....bring it back
 01DF C6 E0              DEC    TIC       Decrement counter
 01E1 D0 F7              BNE    LP        Do it again
 01E3 4C 00 01           JMP    DUMPT     Now--start SUPERTAPE
```

George W. Hawkins, NY

Here's a 2 task (foreground/background?) alternating scheduler routine. This routine (which resides in page one) divides the remainder of page one in half and manages two stacks while alternating control between each task. This allows two programs to be run together in the Kim as long as each program uses the stack or separate memory locations for the storage of temporary data. Set the address of task (program) one into 0100-01, and the address of task two into 0102-03. Connect A15 to E4 and start at 0107. Control will alternate as determined by the interval timer delay value and division rate in locations 0153 and 0155 respectively. Rescheduling will end when one of the programs issues a JMP START back to Kim.

```
****
0100  10            T1L  10.         TASK 1 START ADDRESS (currently = 0010)
0101  00            T1H  00.
0102  00            T2L  00.         TASK 2 START ADDRESS (currently = 0200)
0103  02            T2H  02.
0104  00            TSEL 00.         NEXT TASK TO EXECUTE (alternates)
0105  FF            TSTK FF.         CURRENT STACK POINTER TASK 1
0106  A9            TST1 A9.         TASK 2

0107  A9 00         TINL LDA I  00.    START WITH TASK 1
0109  8D 04 01           STA A  TSEL
010C  8D AD 01           STA A  01,AD  ZERO TASK 2'S STATUS WORD
010F  A2 FF              LDX I  FF.    TASK 1 STACK POINTER
0111  8E 05 01           STX A  TSTK
0114  9A                 TXS           INIT STACK POINTER
0115  A9 A9              LDA I  A9.    TASK 2 STACK POINTER
0117  8D 06 01           STA A  TST1
011A  A9                 A9.           LOAD A
011B  39                  LOW   TINT   WITH INTERRUPT ADDRESS
011C  8D FE 17           STA A  IRQL
011F  A9                 A9.           LOAD A
0120  01                  HIGH  TINT
0121  8D FF 17           STA A  IRQH
0124  AD 02 01           LDA A  T2L    SET TASK 2 START ADDRESS
0127  8D AE 01           STA A  01,AE
012A  AD 03 01           LDA A  T2H
012D  8D AF 01           STA A  01,AF
0130  58                 CLI           INTERRUPTS ON
0131  A9 01              LDA I  01.    1 INTERVAL ON TIMER
0133  8D 0F 17           STA A  17,0F  OF 1024
0136  6C 00 01           JMP @  T1L    START TASK 1

                                       TASK SWITCHING
0139  48            TINT PHA           SAVE A
013A  8A                 TXA           SAVE X
013B  48                 PHA
013C  98                 TYA           SAVE Y
013D  48                 PHA
013E  BA                 TSX           GET STACK POINTER
013F  8A                 TXA
0140  AC 04 01           LDY A  TSEL   GET TASK SELECTOR
0143  99 05 01           STA AY TSTK   SAVE ~~11~~ STACK POINTER
0146  98                 TYA           SELECT OTHER TASK
0147  49 01              EOR I  01.
0149  A8                 TAY
014A  8D 04 01           STA A  TSEL
014D  B9 05 01           LDA AY TSTK   START OTHER TASK
0150  AA                 TAX
0151  9A                 TXS           RESTORE STACK POINTER
0152  A9 01              LDA I  01.    RESCHEDULE 1 INTERVAL
0154  8D 0F 17           STA A  17,0F  OF 1024
0157  A8                 PLA
0158  A8                 TAY           RESTORE Y
0159  68                 PLA
015A  AA                 TAX           RESTORE X
015B  68                 PLA           RESTORE A
015C  40                 RTI           BACK TO MORE USEFUL THINGS   end
```

A CATALOG OF KIM-1 ROM BYTES. (Hal Gerden, Oakland, CA) The debug program TRACER by Larry Fish in the Aug. 1977 KILOBAUD makes innovative use of the 6502 BIT instruction, using masks in memory locations for non-destructive testing of bits in the accumulator. Since BIT lacks the immediate addressing mode, masks must be either at a zero-page or absolute address. Any byte in the KIM ROM can serve as a mask, to test not only single bits but also the absence of 2 or more bits (e.g. BIT with a memory location containing ØF will set the Z flag only if the accumulator bits Ø-3 are all Ø). With the help of a simple program, I found 175 of the 256 possible bytes in the KIM ROM, and recorded the lowest address for each one. The table (high nybble on horizontal, low on vertical) gives this address (e.g., an Ø8 exists at address 1981).

	Ø	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Ø	185D	19A4	18Ø5	1974	1AØ9		193F		1A69	183F	198Ø	1986		181A	1EFD	1884
1	1C3Ø	1C9D	1F6B	1C5F	1897	1DF4	1825	1881		198C		1CB4		18BF		188A
2	1853	1CA1	1E64	18Ø6	18ØB	1FE2		1887			1812		1E1C			1C15
3	19EE	1CA5	19Ø5	186F	181Ø		1CD4						19CD	1C7B	1EF9	18C1
4	1855	19ØØ	184Ø		19A9		1813		1CØF		1CBØ		198F	1E68		1C1Ø
5	1E74	1C91	1F92		1FE4		1F92	1A94	185E		1CDC		1D2Ø	1DF2		1828
6	18BB	1815	1CBF		1A47		194E		1C11		1DC8		1E1Ø		1DAØ	182E
7	188D	18Ø4	18Ø9		19A2				1FEE		19AC				1847	1837
8	1981	187Ø		1A58	19AØ		19C2	1E9C	1994	195C	194C		1A22	1E9B	184D	181B
9	199F	18Ø7	196F		1A66		1957				18ØØ	1D2D	18A5		1894	1822
A	18AA	1898	181D		1962	1C6B	1C4D	1817	1DØB	1A7B	1CF7	1C13	1819		186C	185F
B		1DE2		1CEB	1FDF							1C93		1C75	1996	1861
C	191C	1864	19A1		1862		1C10		197D	18D6	199A		1C82		18Ø3	1C39
D	189C	1C63	1FØ9	1FDD					18Ø2	1CF5	18Ø1	1E31	1836		1834	1A52
E		1AØ3	1A16		1899	182B		19A7	197A	1983	1997		1EE2	1FF4	183A	1C2Ø
F	1871	1C73	1842	1E92	1863		1967	1DEØ			1C62	18ØE	1FEA	18B1	187E	1892

A Compiler for the 6502

Help is needed to complete development of a table driven compiler for the 6502. I have completed the parser and the production procedure programs but have had trouble in deciding which language to implement. Anyone interested in this compiler should contact me as to preference of language, desired features, etc.

I also need help in designing methods to implement parameter passing to subroutines, formatted I/O, and character string handling. If you feel that you could help solve these problems please write me and I will send more information.

I am currently on a SNOBOL compiler but I don't have a great deal of information on it. If anyone has access to BNF descriptions of this and other languages I would gladly pay for copying.

Contact: Ralph Deane, Box 33, Little Fort, B.C. Canada
VOE 2C0

Program BRANCH

by Allen Anway
1219 North 21st St.
Superior, WI 54880

Many times I've pressed the GO button and many times the KIM has flown off into hyperspace somewhere or the stack has punched out my carefully written program in page 1. In self defense I wrote BRANCH to go through my program, find the branch instructions and force the branch to see where I would end up. This program is fully relocatable and uses only locations 0000 and 0001 in the regular RAM. The program uses a few locations at the top of page 0, but this is all right as long as you do NOT single step BRANCH. Enter the program at the beginning and press the following buttons:

KEY 0 Decrement POINTH of address
KEY 1 Decrement POINTL of address
KEY 4 Increment POINTH of address
KEY 5 Increment POINTL of address

When keys held down continuously, the addresses will change continuously after a very short wait.

KEY C Seek branch instruction of the form %XXX1 0000 and stop there. (Be careful, program stops at DATA of this same form.)

KEY D Force the branch, starting at the branch instruction address.

KEY E Above branched correctly, restore old branch address, remain in this program, next press C to look for another branch.

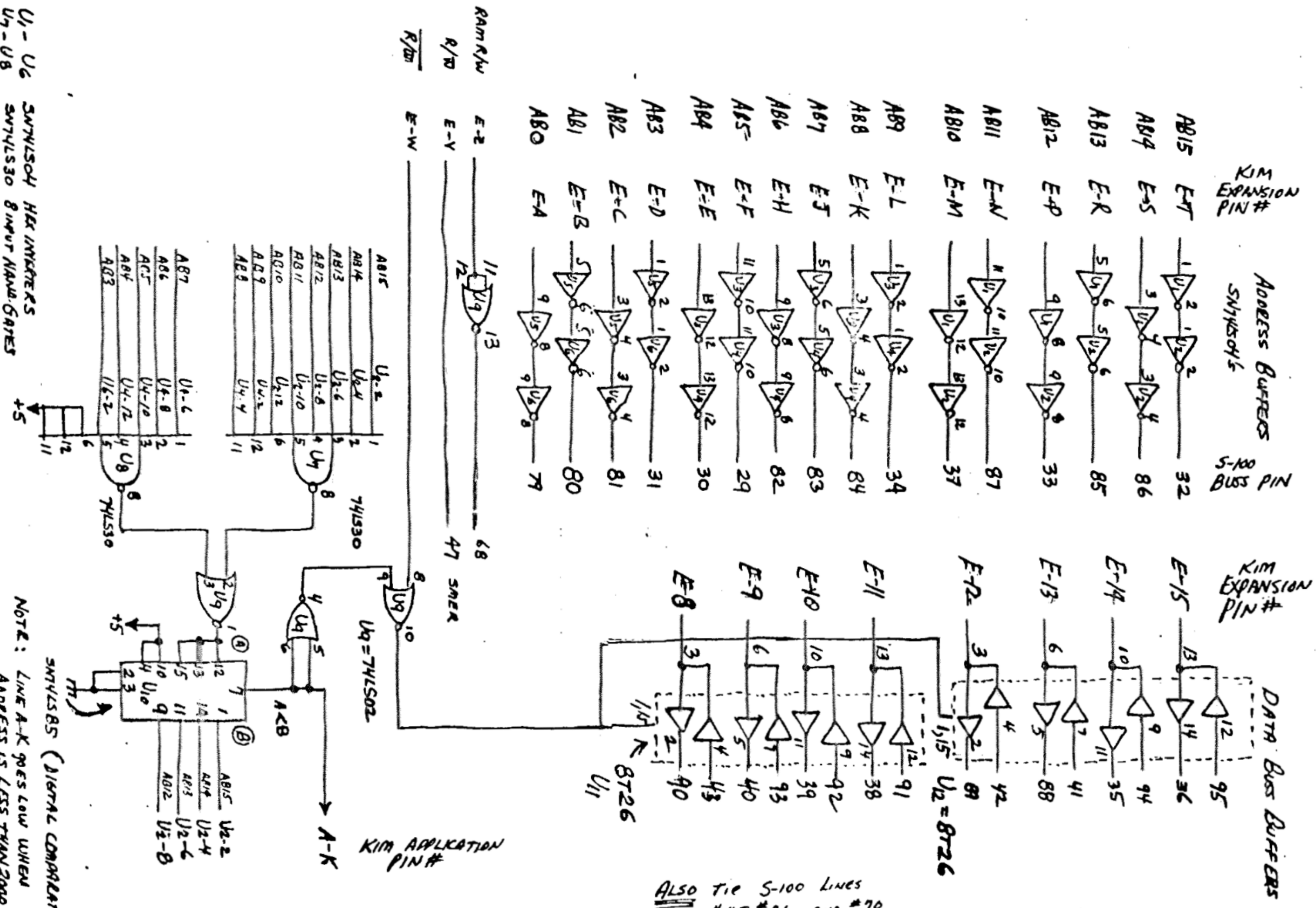
KEY F Above branched incorrectly, stop the program but restore the old branch address so you can correct the erroneous entry. Then press PC and GO and check your new entry by pressing D.

```
0343  08          STARTB  CLD
0344  A5 FA               LDA POINTL
0346  85 EF               STA PCL
0348  A5 FB               LDA POINTH
034A  85 F0               STA PCH   ; PC button is enabled
034C  A5 00               LDA TEML
034E  85 FA               STA POINTL
0350  A5 01               LDA TEMH
0352  85 FB               STA POINTH
- - - - - - - - - - - - - - - - - - -
0354  A9 80       A0      LDA #$80
0356  85 F3               STA NU    ; control repetition
0358  20 19 1F    A1      JSR SCAND
035B  F0 F7               BEQ A0    ; A0 on no key pressed
035D  20 6A 1F            JSR GETKEY
0360  85 F4               STA KEY
0362  A5 F3               LDA NU
0364  85 F1               STA NUM
0366  20 19 1F    A2      JSR SCAND
0369  F0 08               BEQ A3    ; A3 on key released
036B  C6 F1               DEC NUM
036D  D0 F7               BNE A2    ; A2 on key depressed short time
036F  A9 10               LDA #$10  ; key held long time,
0371  85 F3               STA NU    ;   go for repetition
- - - - - - - - - - - - - - - - - - -
0373  A5 F4       A3      LDA KEY
0375  C9 0F               CMP #$0F
0377  D0 08               BNE A4    ; A4 on not key F
0379  A5 00               LDA TEML  ; key F = leave program
037B  85 FA               STA POINTL;   but set up for old branch instruc.
037D  A5 01               LDA TEMH
037F  85 FB               STA POINTH
0381  4C 4F 1C            JMP START
- - - - - - - - - - - - - - - - - - -
0384  C9 0C       A4      CMP #$0C
0386  D0 10               BNE A5    ; A5 on not key C
0388  20 63 1F    A41     JSR INCPT ; key C = seek branch
038B  20 19 1F            JSR SCAND ; pick up program step from SCAND
038E  A5 F9               LDA INH
0390  29 1F               AND #$1F  ; look for branch format
0392  C9 10               CMP #$10
0394  D0 F2               BNE A41   ; A41 on branch not found
0396  F0 BC               BEQ A0    ; stop looking, branch found
- - - - - - - - - - - - - - - - - - -
```

more

```
0398  C9 0D       A5      CMP #$0D
039A  D0 3A               BNE A8    ; A8 on not key D
039C  A5 FA               LDA POINTL; key D = perform jump
039E  85 00               STA TEML
03A0  A5 FB               LDA POINTH
03A2  85 01               STA TEMH
03A4  20 63 1F            JSR INCPT ; go to next location
03A7  20 19 1F            JSR SCAND ; pick up branch distance
03AA  A5 F9               LDA INH   ;   from INH
03AC  48                  PHA
03AD  20 63 1F            JSR INCPT ; next location for easy calc.
03B0  68                  PLA
03B1  18                  CLC
03B2  10 09               BPL A52   ; A52 on branch forward
03B4  65 FA               ADC POINTL; branch backward
03B6  B0 02               BCS A51   ; A51 on no page crossed
03B8  C6 FB               DEC POINTH; page crossed backward
03BA  18          A51     CLC
03BB  90 06               BCC A53
03BD  65 FA       A52     ADC POINTL
03BF  90 02               BCC A53   ; A53 on no page crossed
03C1  E6 FB               INC POINTH; page crossed forward
03C3  85 FA       A53     STA POINTL
03C5  18                  CLC
03C6  90 8C               BCC A0    ; end of calculation
- - - - - - - - - - - - - - - - - - -
03C8  C6 FB       A6      DEC POINTH; from A7 and A8
03CA  B0 8C       A61     BCS A1    ; absolute jump
- - - - - - - - - - - - - - - - - - -
03CC  C6 FA       A7      DEC POINTL; from A8
03CE  A5 FA               LDA POINTL
03D0  C9 FF               CMP #$FF
03D2  F0 F4               BEQ A6
03D4  90 82       A71     BCC A1    ; absolute jump
- - - - - - - - - - - - - - - - - - -
03D6  C9 00       A8      CMP #$00  ; examine remaining keys
03D8  F0 EE               BEQ A6
03DA  C9 01               CMP #$01
03DC  F0 EE               BEQ A7
03DE  C9 04               CMP #$04
03E0  F0 0B               BEQ A9
03E2  C9 05               CMP #$05
03E4  F0 0B               BEQ A10
03E6  C9 0E               CMP #$0E
03E8  F0 0C               BEQ A11
03EA  18                  CLC
03EB  90 E7               BCC A71   ; A71 on no legal key pressed
- - - - - - - - - - - - - - - - - - -
03ED  E6 FB       A9      INC POINTH
03EF  B0 D9               BCS A61   ; absolute jump
- - - - - - - - - - - - - - - - - - -
03F1  20 63 1F    A10     JSR INCPT
03F4  B0 D4               BCS A61   ; absolute jump
- - - - - - - - - - - - - - - - - - -
03F6  A5 00       A11     LDA TEML  ; key E = pick up old branch
03F8  85 FA               STA POINTL;   but remain in program
03FA  A5 01               LDA TEMH
03FC  85 FB               STA POINTH
03FE  B0 CA               BCS A61   ; absolute jump
```

end



U1-U6 SN74LS04 Hex Inverters
U7-U8 SN74LS30 8 Input NAND Gates
U9 SN74LS02 Quad NOR Gate
U10 SN74LS85 Binary Comparator
U11, U12 8T26 Quad Tristate Transceiver

Don't forget to add enough bypass caps.

SN74LS85 (Digital Comparator)

Note: Line A-K goes low when address is less than 2000 hex or more than FFF8 hex.

Kim to S-100 Buss Adapter
By Jim Pollock
7-1-77

Also tie S-100 lines #45, #46, and #70 to ground.

Jim also recommends the Ithaca Audio 8K Ram board (125.00)

Ithaca Audio
P.O. Box 91
Ithaca, N.Y. 14850

Kim-1 → S-100 Bus Adapter

Jim Pollock
New Egypt, N.J.

(Now you can take advantage of all that low-cost memory)

AN ~~[illegible]~~ ?ER OF YOU HAVE REQUESTED BASIC LEVEL PROGRAM EXPLANATION!

HARVEY LAYS AN EXCELLENT TUTORIAL ON US..

- ERIC -

A SIMPLE MUSIC PROGRAM FOR KIM by Harvey Heinz

Undoubtedly, the single most popular use for hobby computers is the programming and playing of games. However, another common use is the playing of music with the micro-computer. Most programs used for this purpose tend to be quite elementary and so it follows that the music generated leaves much to be desired from a quality point of view. Dispite this, music is a good subject for the computer hobbyist to pursue, for the following reasons.

1. The basic principals are very simple but can be elaborated on to any degree desired. In fact,electronic music can become a hobby in itself.
2. Writing a music program makes one very consious of execution times of his machines instruction set.
3. Playing music on the computer is ideal for demonstrating to the layman the versatality of these machines.

As a KIM-1 owner, I had an additional reason for attempting to write such a program. As you know, the 6530 has a programmable interval timer that may be used to interrupt the MPU. I felt that by using this feature, a very simple program could be designed. At the same time I would be gaining experience in using this valuable feature, and also learn something about using the interrupt.

The program which evolved is flow-charted in Fig. 1. Actually there are two separate programs. The main routine consists mostly of initialization. The working part of this program though is the timing loop at the end. Every 4 microseconds Reg. Y is decramented. When the contents of this register become 0, the output is toggled, thus pusing the speaker to the opposite position to the one preveously held. Register Y is then re-initialized, and the process repeats. This will happen continuously until the IRQ line is triggered by the interrupt. The value Reg. Y is initialized to determines the frequency of the note being played.

The interrupt routine is only a little more complicated. The timer has originally been initialized to a value called TEMPO. This value is what determines whether the tune plays fast or slow. The timer is loaded with this value by accessing it with address 170F. This automatically programs the timer to count down 1 for every 1024 clock periods. At the same time, PB7 is initialized to act as an interrupt flag.

Approximately 20 times per second (with TEMPO equal to 28_{16}) the timer will reach 0 and initiate an interrupt. The constant LENGTH is then decremented and tested for 0. If not 0, the timer is re-initialized, and return is then made to the main program. If LENGTH is equal to 0, the interrupt fetches the next note and next duration from the tune table after first checking that the tune is not over. After re-initializing the timer, return is made to the main routine which will now generate the new note.

If the end of tune has been reached during the interrupt, a jump is made direct to the monitor, thus stopping the program. While this is not the proper way to return from an interrupt, in this case it does no harm. Fig. 2 is a listing of both programs.

The tune is listed as a separate table (from the program) and so may be easily changed. Fig. 3 is a listing for the verse and chorus of Swanee River. Even bytes are constants which represent the frequency of the note. The following odd byte is a constant which represents the duration of the note. Refer to Fig. 4 for the correct values to use when coding a different tune.

A suitable value should be stored in TEMPO (00EA) to determ the speed the tune is played at. Try varying this value for(teresting effects. The first empty address after the table s...ld be stored at 00EB to stop the program when the tune is over.

Fig. 4 is a list of musical notes with their correct frequency and period in microseconds. Because our demonstration program has only a single time delay loop, the period must be divided by 4 to make it less then 1024. This does no harm except to raise the frequency generated. Our computer now sounds like a picolo or flute. This modified period is again divided by 4 (our 4 µsec. timing loop) to give the proper argument for that frequency. As this number is decimal,it is finally converted to Hexadecimal to give the correct constant for that note.

The duration argument is derived by determining the shortest note in the selected musical piece. Assign an arbitrary value for this duration. Then simply assign integer multiples of this value for the longer notes. For Swanee River, I used 05 to represent 1 beat. Combining this value with 27 or 28 for TEMPO works out about right.

The hardware end of the project is also simple. Refer to page 57 of your User Manual. Hook up the speaker and transister amplifier as per the diagram, but connect it to PB0 (A9). Then connect PB7 (A15) to IRQ (E4). This last connection should be made through a switch or alligator clip so it can be broken when using the cassette interface.

Using the program can be a lot of fun, as well as being educational. Try slowing down or speeding up the music by changing just the 1 value TEMPO. That's a range of 256 to 1. Or play the tune backwards by changing only a few bytes in the program (decrement X). Or don't load a table at all.Just use the random numbers in memory as a computer generated tune. Anyway have fun. Isn't that what hobby computers are all about?

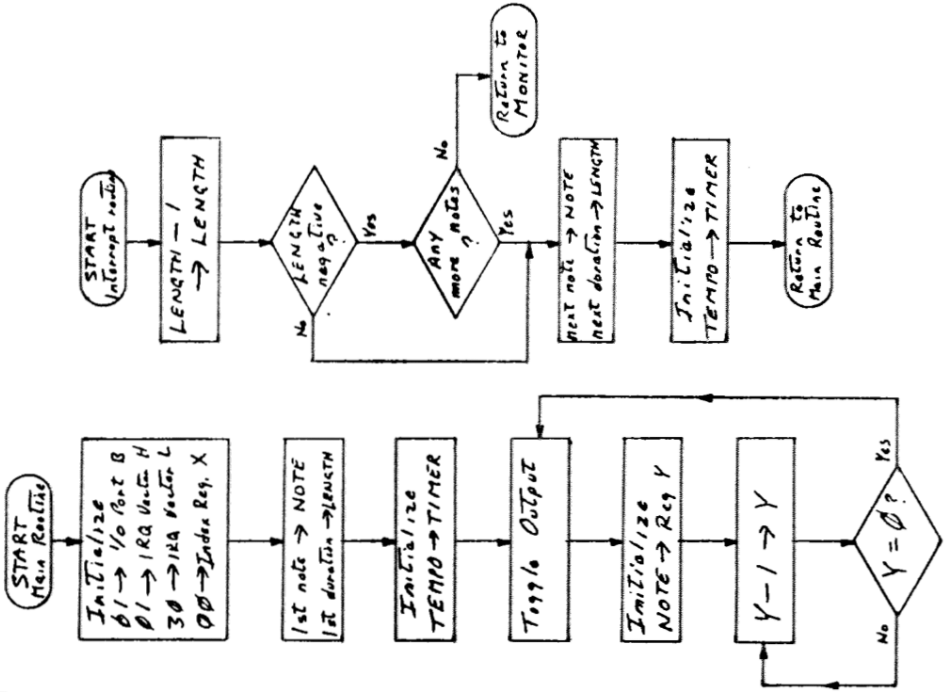


Fig. 1.. MUSIC PROGRAM

more...

Fig. 2--Music Program for KIM-1

A. Main Routine

```
A9  01        0100          LDA #01       Initialize
8D  03  17       2          STA PBDD           I/O Port B
8D  FF  17       5          STA 17FF           IRQ Vector High
A9  27           8          LDA #27            IRQ Vector low
8D  FE  17       A          STA 17FE
A2  00           D          LDX #00            Register X
B5  00           F          LDA TABLE,X
85  E8        0111          STA NOTE      Store first note in NOTE
E8               3          INX
B5  00           4          LDA TABLE,X
85  E9           6          STA LENGTH                   and LENGTH
A5  EA           8          LDA TEMPO     Initialize TIMER
8D  0F  17       A          STA TIMER
EE  02  17       D  PLAY    INC PBO       Toggle output
A4  E8        0120          LDY NOTE      Initialize Reg. Y to NOTE
88               2  DELAY   DEY           Decrement Reg. Y
D0  FD           3          BNE DELAY     If not zero, return
F0  F6        0125          BEQ PLAY      Time delay complete
```

B.Interrupt Routine

```
C6  E9        0127          DEC LENGTH    Decrement LENGTH
30  06           9          BMI NEXTN     If zero, get next note
A5  EA           B          LDA TEMPO     Reinitialize TIMER
8D  0F  17       D          STA TIMER
40            0130          RTI           And return to main routine
E8               1  NEXTN   INX           Increment Index Register
E4  EB           2          CPX END       Test for tune over
D0  03           4          BNE CONT      No? then continue
4C  4F  1C       6          JMP START     Yes. Go to KIM monitor
B5  00           9  CONT    LDA TABLE,X   Fetch next note (Freq.)
85  E8           B          STA NOTE      and store in NOTE
E8               D          INX           Increment Index Reg.
B5  00           E          LDA TABLE,X   Fetch next duration
85  E9        0140          STA LENGTH    and store in LENGTH
A5  EA           2          LDA TEMPO     Reinitialize TIMER
8D  0F  17       4          STA TIMER
40            0147          RTI           Return to main routine
```

0000	Start of TABLE	TABLE
00E8	Location of current note frequency	NOTE
00E9	Location of current note duration	LENGTH
00EA	Constant here determines speed of tune	TEMPO
00EB	Contains first empty address after tune	END

THE FIRST BOOK OF KIM is becoming available in stores across the country. Stan Ockers, Jim Butterfield, and your editor put this book together with the idea of helping newcomers to our hobby to get up to speed on the KIM. (Of course, the book's not just applicable to newcomers). The book includes a beginners guide to programming, several tutorials on hooking things up to KIM, and a large number of game and utility type programs. (many of which have not been published as yet). The First Book Of KIM is 180 pages long in an 8½ X 11 format. It is available for $9.00 (plus $.50 postage) from: ORB, P.O. Box 311, Argonne, Ill. 60439. Personal checks will have to clear the bank, so please send a cashiers check or money order in U.S. funds. Ill. residents please add sales tax.

••••••••••••••••••••••••••••

Fig.3-Table For **Swanee River Tune**

E	4	0000	BE	14
D	1	2	D5	05
C	1	4	EF	05
E	1	6	BE	05
D	1	8	D5	05
C	2	A	EF	0A
C	2	C	77	0A
A	1	E	8E	05
C	3	0010	77	0F
G	4	2	9F	14
E	2	4	BE	0A
C	2	6	EF	0A
D	8	8	D5	28
E	4	A	BE	14
D	1	C	D5	05
C	1	E	EF	05
E	1	0020	BE	05
D	1	2	D5	05
C	2	4	EF	0A
C	2	6	77	0A
A	1	8	8E	05
C	3	A	77	0F
G	2	C	9F	0A
E	1	E	BE	05
C	1	0030	EF	05
D	4	2	D5	14
C	8	4	EF	28
B	3	0036	7F	0F
C	1	8	77	05
D	2	A	6A	0A
G	5	C	9F	19
A	1	E	8E	05
G	2	0040	9F	0A
C	4	2	77	14
A	2	4	8E	0A
F	2	6	B3	0A
A	2	8	8E	CA
G	8	A	9F	28
E	4	C	BE	14
D	1	E	D5	05
C	1	0050	EF	05
E	1	2	BE	05
D	1	4	D5	05
C	2	6	EF	0A
C	2	8	77	0A
A	1	A	8E	05
C	3	C	77	0F
G	2	E	9F	0A
E	1	0060	BE	05
C	1	2	EF	05
D	4	4	D4	14
C	7	6	EF	23

Load 00EB (END) with 68

Load 00EA (TEMPO) with 28

Fig. 4--- Musical Notes with Frequency,Period, & Argument

Note	Frequency	Period	Period/4	Constant	
				Dec.	Hex.
C	261.62	3822.3	956	239	EF
C#	277	3608	902	226	E2
D	294	3405	851	213	D5
D#	311	3214	804	201	C9
E	329.63	3033.8	759	190	BE
F	349	2864	716	179	B3
Fb	370	2703	676	169	A9
G	392	2551	638	160	A0
G#	415	2408	602	151	97
A	440	2273	568	142	8E
A#	466	2145	536	134	86
B	493	2025	506	127	7F
C	523	1911	478	120	78
C#	554	1804	451	113	71
D	587	1703	426	107	6B
D#	622	1607	402	101	65
E	659	1517	379	95	5F
F	698	1432	358	90	5A
F#	740	1351	338	85	55
G	784	1276	319	80	50
G#	831	1204	301	75	4B
A	880	1136	284	71	47
A#	932	1073	268	67	43
B	988	1012	253	63	3F
C	1047	956	239	60	3C

AN A/D CONVERTER FROM... WILL HAPGOOD WALTHAM, MASS

Here is a circuit for making very accurate A/D conversions using a Motorola dual-slope conversion chip. With the values shown, I get conversions of up to 1400 counts with 1 bit accuracy compared to the best digital voltmeter we have; zero drift is non measurable. With a larger integrating capacitor, the circuit will count past 2000 counts; with a longer software timing constant, you can get a full 16 bit count, but with a longer conversion time than the approximately 50 msec. my program uses.

The input signal must be positive, although you can float the return line by about a volt if desired. I set the two potentiometers to mid-scale before beginning adjustments so they won't be too far off. The transistor can be any PNP device, and is for protection against reversed input polarity, which otherwise might latch up the chip. Finally, avoid snapping the power supply on(by inserting a chip into a live socket); it can make the chip very non-linear, or even dead.

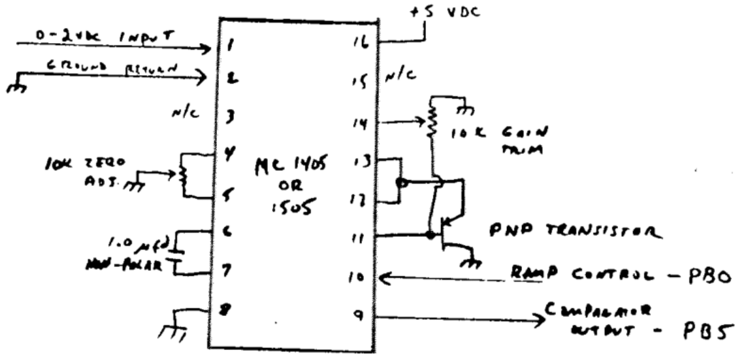
The software is relocatable. It is written for the output line to be PB0 in KIM, and the input line to be PB5. The program controls the ramp line; when it is on, the 1405 integrator is going negative. When it goes below zero(actually below a reference voltage), the ramp is reset and the integrator starts going positive. The up-ramp is timed once it crosses zero. At the end of the timed up ramp, the ramp control line is set, and the time required for the integrator to reach zero is counted. This is proportional to the input value. Subtracting an offset of 5 or 10 percent of the upramp count improves operation near zero; the exact amount subtracted is not critical. Notice the instructions to disable interrupts during the critical counting periods; the software must not be disturbed during this period.

The spec sheet on the MC1505L and Motorola Application Note #AN-757 contain more information on the chip and its use. I am currently using this circuit preceeded by an analog multiplexer to read up to 16 inputs accurately in less than 1 second, using only two computer interface lines. I find the circuit much easier to use than a 12 bit parallel A/D, and much cheaper in the bargin.

The chip operates by integrating a current proportional to the input for a fixed time period(set by the timing constant for the up-ramp). Then a down ramp period subtracts a reference current until the integrating capacitor returns to zero. Thus many circuit variables balance out. Loading Y with $06 and X with $00 is an up-ramp constant of $0600, or 1500 decimal. During the up-ramp, this number is counted to zero to give the up ramp delay time. Once 300 is reached, the ramp direction is reversed, and the same registers are counted up until the integrating capacitor returned to its original level. With the software as it is, I get 1500 decimal counts at an input voltage of 1.5 volts. However, the circuit counts somewhat higher than this before getting non-linear.

To reach a full 16 bit count of 65,000, a larger up ramp timing constant can be specified. This will charge the timing capacitor for a longer time, and result in higher counts for a particular input voltage. You ~~may~~ will have to increase the size of the integrating capacitor to prevent it from limiting; and conversions will take longer as the size of the count goes up. The software as shown results in a 16 bit result but with a maximum count of 2000 decimal or so (an 11 bit range). Fiddle with the timing constant until the system counts linearly up to the desired range; then set the zero offset constant to between 5% and 10% of the up-ramp constant. Adjust the zero offset constant until the circuit zeros; then trim the gain potentiometer for the exact gain required, and finally, re-trim the zero with the zero control.

I've included another listing which adds a simple but clear binary to bcd conversion. The reference to 16 bit number should probably be changed to 17 to avoid confusion.



MC 1405 - A/D CIRCUIT

```
; INPUT MODULE OPERATES A SET-RESET DUAL-SLOPE A-D CONVERTER.
; INPUT LINE = PB5 ($20)
; PB0 IS OUTPUT LINE TO A-D.
; THIS MODULE INCLUDES BCD CONVERSION.
; INPUTS = NONE.  OUTPUTS = MSD IN X; LSD IN Y.
.SKIP 2
INPUT  LDA #%00000001 TURN RAMP ON AT PB0
       ORA PBDATA
       STA PBDATA
       LDA #$20      MASK FOR THIS INPUT
TEM1   BIT PBDATA
       BNE TEM1      LOOP TILL COMP GOES LOW
       LDX #0
       LDY #$06      TIMING CONSTANT FOR UP-RAMP
       DEC PBDATA    TURN RAMP OFF
TEM2   BIT PBDATA
       BEQ TEM2      LOOP TILL COMP GOES HIGH
       SEI          DISABLE IRQ
TEM3   DEX
       BNE TEM3
       DEY
       BNE TEM3
       INC PBDATA    TURN RAMP ON
TEM4   INX
       BNE TEM5
       INY
TEM5   BIT PBDATA
       BNE TEM4
       CLI           ENABLE IRQ
       DEC PBDATA    LEAVE RAMP OFF TO EQUALIZE CONVERSION TIMES
       TXA           SUBTRACT OFFSET TO IMPROVE OPERATION NEAR ZERO.
       SEC
       SBC #$40
       TAX
       TYA
       SBC #0
       TAY
;                    AT THIS POINT, 16 BIT BINARY IS IN Y AND X.
```

more...

```
.SKIP 4
; SUB-MODULE BCD. NORMALLY ENTERED FROM INPUT ABOVE, BUT
; CAN ALSO BE CALLED INDEPENDENTLY.
;
; THIS MODULE CONVERTS A 16 BIT BINARY NUMBER INPUTTED IN
; Y AND X INTO THE 4 DECIMAL DIGITS CONTAINED BY MSD AND LSD.
; IT COUNTS DOWN Y, ADDING 256 TO LSD,MSD; THEN IT COUNTS DOWN
; X WHILE ADDING 1.
.SKIP 1
BCD     SED             USE DECIMAL ADDITION
        LDA #0          CLEAR OUTPUTS
        STA LSD
        STA MSD
        CPY #0          IF MSBITS = 0, DO LSBITS
        BEQ BCD2
BCD1    CLC             ADD 256 TO OUTPUT
        LDA LSD
        ADC #$56
        STA LSD
        LDA MSD
        ADC #2
        STA MSD
        DEY             AND DECREMENT MSBITS BY 1
        BNE BCD1        LOOP TILL ZERO
.SKIP 1
BCD2    CPX #0          IF LSBITS = 0, DONE
        BEQ BCD4
BCD3    CLC             ADD 1 TO OUTPUT
        LDA LSD
        ADC #1
        STA LSD
        LDA MSD
        ADC #0
        STA MSD
        DEX             AND DECREMENT LSBITS
        BNE BCD3        LOOP TILL ZERO
BCD4    LDX MSD
        LDY LSD
        CLD
        RTS
 COPY COMPLETE.
```

KIM BLACKJACK
May 28, 1977

Jim Butterfield
14 Brooklyn Avenue
Toronto M4M 2X5, Canada

Description:

KIM uses a 'real' deck of cards in this game. So when you've seen four aces going by, you know that there will be no more - until the next shuffle.

BLACKJACK starts at address 0200. You'll see the cards being shuffled - the word SHUFFL appears on the display - and then KIM will ask how much you want to bet.

You'll start with an initial amount of $20. Your balance is always shown to the right of the BET? question, so on the first hand, you'll see BET? 20 on the display.

You may bet from $1 to $9, which is the house limit. The instant you hit key 1 to 9 to signal your bet, KIM will deal. Of course, you can't bet more money than you have ... and KIM ignores freeloaders who try to bet a zero amount.

After the deal, you'll see both your cards on the left of the display, and one of KIM's cards on the right. (KIM's other card is a "hole" card, and you won't see it until it's KIM's turn to play). Aces are shown as letter A, face cards and tens as letter F, and other cards as their value, two to nine. As always, Aces count value 1 or 11 and face cards count 10.

You can call for a third card by hitting the 3 button .. then the fourth card with the 4 button, and so on. If your total goes over 21 points, KIM will ungrammatically say BUSTED, and you'll lose. If you get five cards without exceeding 21 points, you'll win automatically. If you don't want any more cards, hit key 0. KIM will report your point total, and then will show and play its own hand. KIM, too, might go BUSTED or win on a five-card hand. Otherwise, the most points wins.

From time to time, KIM will advise SHUFFL when the cards start to run low.

Remember that you have a good chance to beat KIM at this game. Keep track of the cards that have been dealt (especially aces and face cards), and you're likely to be a winner!

KIM BLACKJACK

```
0200 A2 33    START  LDX #51      52 cards in deck
0202 8A       DK1    TXA          Create deck
0203 95 40           STA DECK,X    by inserting cards
0205 CA              DEX            into deck
0206 10 FA           BPL DK1         in sequence
0208 A2 02           LDX #2       Set up 3 locations
020A BD BB 03 INLOP  LDA INIT,X      ..into..
020D 95 75           STA PARAM        zero page
020F CA              DEX          addresshi/ dpt/ amt
0210 10 F8           BPL INLOP
0212 AD 04 17        LDA TIMER    use random timer
0215 85 80           STA RND       to seed random chain
0217 D8       DEAL   CLD          main loop repeats here
0218 A6 76           LDX DPT      next-card pointer
021A E0 09           CPX #9       less than 9 cards?
021C B0 34           BCS NOSHUF   9 or more, don't shuffl
                  ; shuffle deck
021E A0 D8           LDY #SHUF-$300  Set up SHUFFL msg
0220 20 57 03        JSR FILL          put in WINDOW
0223 A0 33           LDY #51           ripple 52 cards
0225 84 76           STY DPT      set full deck
0227 20 30 03 SHLP   JSR LIGHT    illuminate display
022A 38              SEC
022B A5 81           LDA RND+1    Generate
022D 65 82           ADC RND+2     new
022F 65 85           ADC RND+5      random
0231 85 80           STA RND         number
0233 A2 04           LDX #4
0235 B5 80    RMOV   LDA RND,X    move over
0237 95 81           STA RND+1,X   the random
0239 CA              DEX            seed numbers
023A 10 F9           BPL RMOV
023C 29 3F           AND #$3F     Strip to 0-63 range
023E C9 34           CMP #52      Over 51?
0240 B0 E5           BCS SHLP     yes, try new number
                  ; swap each card into random slot
0242 AA              TAX
0243 B9 40 00        LDA DECK,Y   get next card
0246 48              PHA          save it
0247 B5 40           LDA DECK,X   get random card
0249 99 40 00        STA DECK,Y    into position N
024C 68              PLA          and the original card
024D 95 40           STA DECK,X    into the random slot
024F 88              DEY          next in sequence
0250 10 D5           BPL SHLP     bck for next card
```

more ↓

KIM BLACKJACK

```
                      ; ready to accept bet
0252 A0 DE     NOSHUF LDY #MBET-$300   Set up BET? msg
0254 20 57 03         JSR FILL         put in WINDOW
0257 A5 77            LDA AMT      display balance
0259 20 A6 03         JSR NUMDIS     .. put in WINDOW
025C 20 30 03 BETIN   JSR LIGHT    illuminate display
025F C9 0A            CMP #10      not key 0 to 9?
0261 B0 F9            BCS BETIN    nope, ignore
0263 AA               TAX
0264 86 79            STX BET      store bet amount
0266 CA               DEX
0267 30 F3            BMI BETIN    zero bet?
0269 E4 77            CPX AMT      sufficient funds?
026B B0 EF            BCS BETIN    no, refuse bet
                      ; bet accepted - deal
026D A2 0B            LDX #11      Clean WINDOW and
026F A9 00            LDA #0           card counters
0271 95 90     CLOOP  STA WINDOW,X
0273 CA               DEX
0274 10 FB            BPL CLOOP
                      ; here come the cards
0276 20 78 03         JSR YOU      one for you..
0279 20 8F 03         JSR ME       & one for me..
027C 20 78 03         JSR YOU      another for you..
027F 20 64 03         JSR CARD     put my second card..
0282 86 7A            STX HOLE      ..in the hole
0284 20 28 03         JSR WLITE    wait a moment
                      ; deal complete - wait for Hit or Stand
0287 20 30 03 TRY     JSR LIGHT
028A AA CA            TAX DEX     key input?
028C 30 11            BMI HOLD    zero for Stand?
028E E4 96            CPX UCNT    N for card #n?
0290 D0 F5            BNE TRY     nope, ignore  key
                      ; Hit - deal another card
0292 20 78 03         JSR YOU      deal it
0295 C9 22            CMP #$22     22 or over?
0297 B0 40            BCS UBUST    yup, you bust
0299 E0 05            CPX #5       5 cards?
029B F0 53            BEQ UWIN     yup, you win
029D D0 E8            BNE TRY      nope, keep going
                      ; Stand - show player's total
029F A5 95     HOLD   LDA WINDOW+5   save KIM card
02A1 48               PHA                on stack
02A2 A2 00            LDX #0       flag player ..
02A4 20 0F 03         JSR SHTOT      .. for total display
02A7 A2 04            LDX #4
02A9 A9 00            LDA #0
02AB 95 90     HLOOP  STA WINDOW,X   clean window
02AD CA               DEX
02AE 10 FB            BPL HLOOP

                      ; restore display card and hole card
02B0 68               PLA          display card
02B1 85 95            STA WINDOW+5  back to display
02B3 A6 7A            LDX HOLE     get hole card
02B5 20 6D 03         JSR CREC     rebuild
02B8 20 92 03         JSR MEX      play and display
                      ; KIM plays here
02BB 20 28 03 PLAY    JSR WLITE    pause to show cards
02BE A5 9A            LDA MTOT     point total
02C0 C9 22            CMP #$22      ..22 or over?
02C2 B0 29            BCS IBUST      yup, KIM bust
02C4 65 9B            ADC MACE     add 10 for aces?
02C6 A6 91            LDX WINDOW+1  five cards?
02C8 D0 18            BNE IWIN       yes, KIM wins
02CA C9 22            CMP #$22     22+ including aces?
02CC 90 02            BCC POV      nope, count ace high
02CE A5 9A            LDA MTOT     yup, ace low
```

```
02D0 C9 17     POV    CMP #$17     17 or over?
02D2 B0 2C            BCS HOLD2     yes, stand..
02D4 20 8F 03         JSR ME        no, hit..
02D7 D0 E2            BNE PLAY     unconditional Branch
                      ; KIM wins here
02D9 20 28 03 UBUST   JSR WLITE    show player's hand..
02DC 20 55 03         JSR BUST     make BUST message..
02DF 20 28 03         JSR WLITE    ..and show it
02E2 A5 77     IWIN   LDA AMT      decrease balance
02E4 F8 38            SED SEC
02E6 E5 79            SBC BET      ..by amount of bet
02E8 85 77     JLINK  STA AMT      store new balance
02EA 4C 17 02 XLINK   JMP DEAL     next play
                      ; Player wins here
02ED 20 55 03 IBUST   JSR BUST     make BUST message..
02F0 20 28 03 UWIN    JSR WLITE    display pause
02F3 A5 77     ADD    LDA AMT      increase balance
02F5 F8 18            SED CLC
02F7 65 79            ADC BET      by amount of bet
02F9 A0 99            LDY #$99     $99 maximum..
02FB 90 01            BCC NOFLO    have we passed it?
02FD 98               TYA          yes, restore $99
02FE D0 E8            BNE JLINK    unconditional branch
                      ; KIM stands - compare points
0300 A2 03     HOLD2  LDX #3       flag KIM..
0302 20 0F 03         JSR SHOTOT    .. for total display
0305 A5 9A            LDA MTOT     KIM's total..
0307 C5 97            CMP UTOT     vs. Player's total..
0309 F0 DF            BEQ XLINK    same, no score;
030B B0 D5            BCS IWIN     KIM higher, wins;
030D 90 E4            BCC ADD      KIM lower, loses.

                      ; subroutines start here
                      ; SHTOT shows point totals per X register
030F B5 97     SHTOT  LDA UTOT,X   player's or KIM's total
0311 F8 18            SED CLC
0313 75 98            ADC UACE,X   try adding Ace points
0315 C9 22            CMP #$22     exceeds 21 total?
0317 B0 02            BCS SHOVER   yes, skip
0319 95 97            STA UTOT,X   no, make permanent
031B D8        SHOVER CLD
031C B5 97            LDA UTOT,X   get revised total
031E 48               PHA          save it
031F A0 E2            LDY #TOT-$300  set up TOT- msg
0321 20 57 03         JSR FILL      put in WINDOW
0324 68               PLA          recall total
0325 20 A6 03         JSR NUMDIS   insert in window
                      ; display pause, approx 1 second
0328 A0 80     WLITE  LDY #$80     timing constant
032A 20 30 03 WDO     JSR LIGHT    illuminate screen
032D 88               DEY         countdown
032E D0 FA            BNE WDO
                      ; illuminate display
0330 84 7F     LIGHT  STY YSAV    save register
0332 A0 13            LDY #$13
0334 A2 05            LDX #$5     6 digits to show
0336 A9 7F            LDA #$7F
0338 8D 41 17         STA PADD    set directional reg
033B B5 90     DIGIT  LDA WINDOW,X
033D 8D 40 17         STA SAD     character segments
0340 8C 42 17         STY SBD     character ID
0343 E6 7B     WAIT   INC PAUSE
0345 D0 FC            BNE WAIT    wait loop
0347 88 88            DEY DEY
0349 CA               DEX
034A 10 EF            BPL DIGIT
034C 20 40 1F         JSR KEYIN   switch Dir Reg
034F 20 6A 1F         JSR GETKEY  test keyboard
0352 A4 7F            LDY YSAV    restore Y value
0354 60               RTS
```

```
                  ; fill WINDOW with BUST or other message
0355 A0 E6        BUST   LDY #$BST-$300
0357 84 74        FILL   STY POINTR
0359 A0 05               LDY #5       six digits to move
035B B1 74        FILLIT LDA (POINTR),Y  load a digit
035D 99 90 00            STA WINDOW,Y    put in window
0360 88                  DEY
0361 10 F8               BPL FILLIT
0363 60                  RTS

                  ; deal a card, calc value & segments
0364 A6 76        CARD   LDX DPT      Pointer in deck
0366 C6 76               DEC DPT      Move pointer
0368 B5 40               LDA DECK,X   Get the card
036A 4A 4A               LSRA LSRA    Drop the suit
036C AA                  TAX          0 to 12 in X
036D 18           CREC   CLC          no-ace flag
036E D0 01               BNE NOTACE   branch if not ace
0370 38                  SEC          ace flag
0371 BD BE 03            LDA VALUE,X   value from table
0374 BC CB 03            LDY SEGS,X    segments from table
0377 60                  RTS
                  ; card to player, including display & count
0378 20 64 03 YOU        JSR CARD    deal card
037B E6 96               INC UCNT    card count
037D A6 96               LDX UCNT    use as display pointer
037F 94 8F               STY WINDOW-1,X   put card in Wndw
0381 A0 10               LDY #$10    ten count for aces
0383 90 02               BCC YOVER   no ace?
0385 84 98               STY UACE    ace, set 10 flag
0397 18 F8        YOVER  CLC SED
0389 65 97               ADC UTOT    add points to..
038B 85 97               STA UTOT     ..point total
038D D8                  CLD
038E 60                  RTS
                  ; card to KIM, including display & counts
038F 20 64 03 ME         JSR CARD     deal card
0392 C6 99        MEX    DEC MCNT     inverted count
0394 A6 99               LDX MCNT     use as (r) display pontr
0396 94 96               STY WINDOW+6,X   into window
0398 A0 10               LDY #$10    ten count for aces
039A 90 02               BCC MOVER   no ace?
039C 84 9B               STY MACE    ace, set 10 flag
039E 18 F8        MOVER  CLC SED
03A0 65 9A               ADC MTOT    add points to..
03A2 85 9A               STA MTOT      .. point total
03A4 D8                  CLD
03A5 60                  RTS
                  ; transfer number in A  to display
03A6 48           NUMDIS PHA         save number
03A7 4A 4A               ISRA LSRA   extract left digit
03A9 4A 4A               LSRA LSRA
03AB A8                  TAY
03AC B9 E7 1F            LDA TABLE,Y  convert to segments
03AF 85 94               STA WINDOW+4
03B1 68                  PLA          restore digit
03B2 29 0F               AND #$0F     extract right digit
03B4 A8                  TAY
03B5 B9 E7 1F            LDA TABLE,Y  convert to segments
03B8 85 95               STA WINDOW+5
03BA 60                  RTS
                  ; tables in hex format
03BB 03 00 20  01 02 03 04 05 06 07 08 09 10 10 10 10
03CB F7 DB CF  E6 ED FD 87 FF EF F1 F1 F1 F1
03D8 ED F6 BE F1 F1 B8  FC F9 F8 D3
03E2 F8 DC F8 C0   FC BE ED 87 F9 DE
```

03EC end

'XIM'

(Extended I/O Monitor)

A TTY, command oriented, programming tool for KIM-1

1. Resides in 1K of memory. Relocatable (with checklist) and ROM-able.
2. Adds 17 commands to resident KIM TTY monitor.
3. Includes 4 user defined commands for expansion.
4. Designed around a modular concept for easy modification.

FUNCTIONS

*Load alpha-numeric (ASCII) characters into ram via TTY.
*Print a memory block on the TTY as alpha-numeric (ASCII) characters.
*Calculate relative branches.
*Compare two data blocks and display all discrepancies.
*Load op-codes and operands into memory sequentially via TTY.
*Execute a program at a designated address.
*HEX Dump: Display memory as a 16 column matrix of two digit HEX codes.
*Jump to the KIM monitor.
*Fill a data block with a constant.
*Move one block of data to another.
*Block-search for a string of data up to 256 bytes long in any given block and display the starting address(es) of the string.
*Set up the audio tape address buffers via TTY in sequential fashion.
*CONTROL D. Used for command termination, during initialization.

Break point (BRK) service routine.

BRK point processing routine saves and displays all CPU registers on the TTY. Status register is printed as a string of 1's and 0's for program debugging.

Features OP-code reinsertion at BRK point for multi BRK processing.

Manual & Cassette: $12.00
Manual & Punched tape: $10.00
(post paid USA)
NJ residents add 5% tax.

PYRAMID DATA SYSTEMS
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New Egypt, N.J.
08533

A NUMBER OF YOU HAVE WANTED A LIST OF KIM MONITOR ROUTINES WITH EXPLANATIONS

B. STRANSTOFT 03.02.77
Mollebakken 27
GUDERUP
6430 NORDBURG
DENMARK

```
**** KIM-1 RESIDENT PROGRAM'S AND SUBROUTINE'S ****

-NAME-   -COMMENT-

MAIN
    DUMPT    DUMP MEM TO TAPE
    LOADT    LOAD MEM FROM TAPE
    INTVEB   SUB TO MOVE SA TO VEB +1.2
    CHKT     COMPUTE CHKSUM FOR TAPELOAD. RTN USES Y TO SAVX +
    OUTBTC   OUTPUT ONE BYTE. USES Y TO SAVX BYTE
    OUTBT    OUTBTC WITHOUT CHKSUM
    HEXOUT   CONVERT LSD OF A TO ASCII AND OUTPUT TO TAPE
    OUTCHT   OUTPUT TO TAPE ONE ASCII CHAR VIA SUB'S ONE + ZERO
SUB'S
    ONE      OUTPUT '1' TO TAPE. 9 PULSES 138 MICROSEC EACH
    ZRO      OUTPUT '0' TO TAPE. 6 PULSES 207 MICROSEC EACH
    INCVEB   SUB TO INC VEB+1,2
    RDBYT    SUB TO READ BYTE FROM TAPE
    RDBYT2   MULTI ENTRY POINT
    PACKT    PACK A=ASCII INTO SAVX AS HEX DATA
    RDCHT    GET 1 CHAR FROM TAPE. RETURN CHAR IN A. USE SAVX+1 TO ASM CHAR
    RDBIT    GETS ONE BIT FROM TAPE AND RETURNS IT IN SIGN OF A
MAIN
    PLLCAL   OUTPUT 166 MICROSEC PULSE STRING FOR TAPE-PLL CALIBRATION
    SAVE     KIM ENTRY VIA STOP (NMI) OR BRK (IRQ)
    SAVE1    KIM ENTRY VIA JSR (A LOST)
    SAVE2    (ISS) X, Y, S
    RST      KIM ENTRY VIA RST
    DETCPS   DETECT CHAR PER SEC ( BAUD-RATE )
    START    MAKE TTY/KB SELECTION
    CLEAR    CLEAR INPUT BUFFER INH, INL AND READ
    READ     GET CHAR
    TTYKB    MAIN ROUTINE FOR KEYBOARD AND DISPLAY. IF NO KEY, A= 0
    GETK     KIM-KEYBOARD FETCH-PROGRAM
    GET5     TEST CHAR IN DETCPS
    DATA     SHIFT CHAR IN A INTO HIGH ORDER NIBBLE AND DISPLAY
    ADDR     DISP ADR
    STEP     INCPT + START
    PCCMD    DISPLAY PC BY MOVING PC TO POINT
    LOAD     LOAD PAPERTAPE FROM TTY. CHECK FOR ';'
    LOADS    LOAD PAPERTAPE FROM TTY. CHECK FOR BYTECOUNT
    DUMP     DUMP TO TTY FROM OPEN CELL ADRESS TO LIMHL, LIMHH
    SPACE    OPEN NEW CELL
    SHOW     PRINT OPEN CELL
    RTRN     OPEN NEXT CELL
    GOEXEC   RUN-ISS. PROGRAM RUNS FROM OPEN CELL ADR
    SCAN     TTY-CMD DETECTION PROG
    FEED     OPEN PREVIOUS CELL. PRINT
    MODIFY   GET CONTENTS OF INPUT BUFF INL AND STORE IN LOC SPECIFIED BY POINT
SUB'S
    PRTPNT   SUB TO PRINT POINTL, POINTH
    CRLF     SUB TO PRINT CR + LF
    PRTST    PRINT STRING OF ASCII CHAR FROM TOP+X TO TOP
    PRTBYT   PRINT ONE HEX BYTE AS TWO ASCII CHAR'S
    HEXTA    CONVERT TO HEX NIBBLE AND PRINT ASCII
    GETCH    GET 1 CHAR FROM TTY. CHAR IN A. X PRESERVED. Y = FF
    GET5     GETCH MULTI ENTRY POINT
    INITS    INITIALIZATION FOR SIGMA
    INIT1    INITS MULTI ENTRY POINT
    OUTSP    PRINTS 1 SPACE
    OUTCH    PRINT 1 CHAR = A. X PRESERVED. Y = FF
    DELAY    DELAY 1 BIT. TIME AS DETERMED BY DETCPS
    DEHALF   DELAY HALF BIT TIME
    AK       KEY NOT DEP OR TTY MODE, A=0. KEY DEP OR KB MODE, A NOT ZERO
    ONEKEY   LIKE AK, BUT X, Y NOT INITIATED
    SCAND    OUTPUT 3 BYTES TO 7 SEGMENT DISPLAY. DATA SPECIFIED BY POINT
    SCANDS   OUTPUT TO 7 SEGMENT DISPLAY.
    CONVD    CONVERT AND DISP HEX. (SCAND)
    INCPT    SUB TO INCREMENT POINTL, POINTH
    GETKEY   FROM KEYBOARD. A = KEYVALUE. ILLEGAL OR NO KEY FOR A GT. 15
    CHK      SUB TO COMPUTE CHECK SUM
    GETBYT   GET 2 HEX CHAR'S AND PACK INTO INL, INH. X PRESERVED. Y = 0
    PACK     SHIFT CHAR IN A INTO INL, INH. A = 0 FOR HEX
    HEXNUM   CONVERT TO HEX NUM WITHOUT CHECK. A = 0
    HEXALP   CONVERT TO HEX ALPHA
    UPDATE   SHIFT A INTO MSD AND STORE IN I/O BUFFER INL, INH
    OPEN     MOVE I/O BUFFER INL, INH TO POINTL, POINTH

    TAB      KIM MESSAGE TABLE AND 7-SEGMENT CONVERT TABLE
```

A KIM BIBLIOGRAPHY FROM....

WILLIAM R. DIAL
438 ROSLYN AVE
AKRON, OHIO
44320

Ohio Scientific Instruments, 11679 Hayden Ave., Hiram, OH 44234
"Model 300 Computer - Trainer Lab Manual"
A series of 20 programs for instruction on the 6502 microprocessor based Model 300 Trainer. Programs are easily adapted to KIM-1 operation.

Ohio Scientific Instruments, 11679 Hayden St., Hiram, OH 44234
"Application Note No. 2"
OSI 480 Backplane and Expansion System.

Ohio Scientific Instruments, 11679 Hayden St., Hiram, OH 44234
"OSI Application Note No. 5"
Interfacing OSI Boards to other systems including KIM-1.

Ohio Scientific Instruments, 11679 Hayden St., Hiram, OH 44234
"OSI Model 430 Super I/O Board Instruction Manual"

Ohio Scientific Instruments, 11679 Hayden St., Hiram, OH 44234
"Model 420C, 4K Memory Expansion Board"
Instruction Manual - use together with OSI Application Note No. 2 on the 480 Backplane and Application Note No. 5 on interfacing OSI boards to other systems including KIM-1.

ON-LINE, 24695 Santa Cruz Hwy., Los Gatos, CA 95030
This classified ad newsletter often announces KIM-1 and 6502 software and hardware accessories. 18 issued $3.75.

Helmers, Carl, "There's More to Blinking Lights Than Meets the Eye"
Byte 1, No. 5, pp. 52-54 (January 1976)
A program for creating patterns of flashing lights (LEDs).

Lloyd, Robert G., "There's More to Blinking Lights, etc."
KIM-1/6502 Users Notes
A KIM-1 version of Carl Helmers earlier program in Byte.

Ziegler, John, "Breakpoint Routine for 6502"
Dr Dobbs Journal 1, No. 3, pp. 17-19 (1976)
Requires a terminal and a TIM Monitor. Upon entering, the program counter is printed, followed by the active flags, accumulator, register, Y register and stack pointer.

Anon., "What's New Kim-o-sabee?"
Byte 1, No. 8, p. 14 (April 1976)
Brief notes on KIM-1.

Espinosa, Chris, "A String Output Subroutine for the 6502"
DDJ 1, No. 8, p. 33 (September 1976)
This routine saves pointers, loops, etc. in outputting the string.

Meier, Marcel, "6502 String Output, Revisited"
DDJ 1, No. 10, p. 50 (November 1976)
Further mod of Espinosa's earlier routine.

ANON., "Control Logic for Microprocessor Enables Single Step"
Electronic Design, p. 78 (October 11, 1976)
Uses 6502 system.

ANON., "6502 Disassembler"
Interface Age, p. 14 (September 1976)

Butterfield, Jim, "KIM Goes to the Moon"
Byte 2, No. 4, pp. 8-9, 132 (April 1977)
A lunar lander program; see also same program in KIM-1/6502 users notes.

Hybrid Technologies, P.O. Box 163, Burnham, PA 17009
"Ad for KIM-1 Peripherals"
Byte 2, No. 8, p. 157 (August 1977)
2K/8K ROM based, EProm Programmer, 2K/4K/8K Ram boards, assembler board, TV Interface board, relay board, mother boards.

Laabs, John, "Build a $20 EPROM Programmer"
Kilobaud No. 9, pp. 70-77, (Sept 1977)
KIM-1 is used to run software and some external hardware to program the 5204 4K EPROM.

Ohio Scientific Instruments, Hiram, Ohio, 44234, "A Computer that Thinks in BASIC"
Kilobaud No. 9, p. 10, (Sept 1977)
Announcement of OSI's Model 500 CPU board built on 6502. Complete with 8K Basic in ROM for $298.

Clarke, Sheila, "A PET for Every Home"
Kilobaud No. 9, pp. 40-42, (Sept 1977)
A look at the Commodore PET 2001 based on the 6502. About $600 includes Video terminal keyboard, 12K, (8K Basic in ROM and 4K operating system).

American Institute for Professional Education, Carnegie Bldg., Hillcrest Road, Madison, N. J., 07940, "Microprocessing Fundamentals"
Circular Advertisement - approx. Aug 15, 1977.
Dr. Joseph B. Ross, Purdue Univ. and Dr. Garnett Hill, Oklahoma State Univ. will present a course in Fall of 1977 at several locations. Course is based on KIM-1 hardware together with instruction in Digital Devices, Programing Fundamentals, Advanced Programing, Peripherals, I/O addressing, applications, etc. Cost about $600 including a KIM-1 to keep after the course.

Gregson, Wilfred J. II, "RTTY with the KIM"
73 Magazine 9 No. 204, p 110-112 (Sept 1977)
A clever program for using KIM-1 and the 6-digit LED display as a readout for a RTTY signal. Simply feed the audio from a receiver into the tape input of KIM-1 and read the message as it flows across the display (about 45.5 baud, 60 wpm). Can also handle other ratio to 100 baud). Can also use KIM-1 as a display only, operating from an already available terminal unit.

Bumgarner, John O., "A-KIM-1 Sidereal/Solar Clock"
Interface Age 2 No. 9, p-36-37 (Aug 1977)

Atkins, R. Travis, "A New Dress for KIM"
Byte 2 No. 9, p-26-27 (Sept 1977)
Describes mounting the KIM-1 in a briefcase together with power supply, prototype boards, etc.

Chamberlin, Hal, "A Sampling of Techniques for Computer Performance of Music"
Byte 2 No. 9, p-62-83 (Sept 1977)
General Discussion of Music Generation plus detailed information on application to KIM-1 and a description of the hardware and software for a D/A music board and software package being marketed by Micro Technology Unlimited, 29 Mead St., Manchester, N.J., 03104. PC board alone is $6.00, assembled and tested D/A board $35.00, software package on KIM cassette is $13.00 additional.

Beals, Gene, PO Box 371, Montgomeryville, PA 18936, "User Group for the Commodore PET 2001 Computer"
Ref: On Line 2 No. 11 pg 2 (Aug 24, 1977)
Yearly membership $5.00 brings Users Notes publication.

Cater, J., 11620 Whisper Trail, San Antonio TX 78230, "Run OSI 6502 8K Basic on your TIM or JOLT"
On Line 2 No. 11, p. 3 (Aug 24, 1977)
Cost $4.00 for annotated source and object code of patches for TIM or JOLT."

Firth, Mike, 104 N. St. Mary, Dallas, Texas 75214, "Large Type Summary of Command Coder for 6502 plus addresses."
On Line 2 No. 11, p. 8 (Aug 24, 2977)
Cost: $0.13 stamp plus SASE.

House, Gil, PO Box 158, Clarksburg, Md., 20734, "6502 Legible Tape Labeler."
On Line 2 No. 11, p. 9 (Aug 24, 1977)
A program for TIM (JOLT DEMON), Hex tape and documentation $4.00

cont. on pg. 21

TTY RAPID LOAD

Markus P.Goenner,Buel,3205 Mauss,Switzerland

```
ØØØØ      D8             SIMPLD     CLD
ØØØ1      A9 ØØ                     LDA #$ØØ
ØØØ3      85 F8                     STA INL
ØØØ5      85 F9                     STA INH
ØØØ7      2Ø 2F 1E                  JSR CRLF
ØØØA      2Ø 5A 1E       ADDR       JSR GETCH
ØØØD      C9 ØD                     CMP #'CR
ØØØF      FØ Ø5                     BEQ DATA
ØØ11      2Ø AC 1F                  JSR PACK
ØØ14      FØ F4                     BEQ ADDR
ØØ16      A5 F8          DATA       LDA INL
ØØ18      85 FA                     STA POINTL
ØØ1A      A5 F9                     LDA INH
ØØ1C      85 FB                     STA POINTH
ØØ1E      2Ø 2F 1E       LINE       JSR CRLF
ØØ21      2Ø 5A 1E       INPUT      JSR GETCH
ØØ24      C9 ØD                     CMP #'CR
ØØ26      FØ F6                     BEQ LINE
ØØ28      C9 1B                     CMP #'ESC
ØØ2A      DØ ØB                     BNE STORE
ØØ2C      A9 24                     LDA #'$
ØØ2E      2Ø AØ 1E                  JSR OUTCH
ØØ31      2Ø 2F 1E                  JSR CRLF
ØØ34      4C 64 1C                  JMP CLEAR
ØØ37      2Ø AC 1F       STORE      JSR PACK
ØØ3A      DØ E5                     BNE INPUT
ØØ3C      2Ø 5A 1E                  JSR GETCH
ØØ3F      2Ø AC 1F                  JSR PACK
ØØ42      AØ ØØ                     LDY #$ØØ
ØØ44      A5 F8                     LDA INL
ØØ46      91 FA                     STA (POINTL),Y
ØØ48      2Ø 63 1F                  JSR INCPT
ØØ4B      18                        CLC
ØØ4C      9Ø D3                     BCC INPUT
```

PROGRAM-START: ØØØØ

PROGRAM DESCRIPTION:
AFTER YOU HIT THE "G"-KEY ON THE TTY,THE PROGRAM ANSWERS WITH A "CR-LF".
ENTER NOW THE ADDRESS WHERE YOU WISH TO LOAD DATA. LEADING ZERO'S NEED NOT TO BE ENTERED FOR THE ADDRESS FIELD.ON A "CR" FROM YOU,THE TTY PROCEED A "CR-LF" AND YOU ARE READY FOR ENTERING DATA IN HEXA CODE.JUST ONE BYTE AFTER THE OTHER.AT THE END OF A LINE,TYPE A "CR".TO JUMP BACK IN THE MONITOR, TYPE AN "ESC" AND THE TERMINAL WILL PRINT A DOLLAR SIGN BEFORE A "CR-LF" AND THEN YOU ARE BACK IN THE KIM-MONITOR.
BY THE WAY,THE PROGRAM IS FULLY RELOCATABLE.

```
ØØØØ D8 G
Ø2ØØ
D8A9ØØ85F885F92Ø2F1E2Ø5A1EC9ØDFØØ52ØAC1FFØF4A5F885
FAA5F985FB2Ø2F1E2Ø5A1EC9ØDFØF6C91BDØØBA9242ØAØ1E2Ø
2F1E4C641C2ØAC1FDØE52Ø5A1E2ØAC1FAØØØA5F891FA2Ø631F
189ØD3$
```

Add this to t(eal Time Clock program from issue #4. If you didn't   #4, then you'll find the RTC in THE FIRST BOOK OF KIM.......the editor

Charles H. Parsons
80 Longview Rd.
Monroe Conn   06468

This is the temperature control I mentioned. That's about it for now. All this could be expanded or consolidated if desired.

I thought you might be interested in one thing which gave me a lot of trouble. When comparing the current temperature with the table I first tried to use BMI. This worked most of the time and then at a certain point it fell through. The trouble was that this is meant to be used with signed arithmetic and does not work if the subtraction results in a number that looks like a signed negative number. Switching to BCC cleared this up. Its easy enough to say " Look at the manual" but if you think you are doing the right thing this does not occur to you immediatly. I don't know if others have fallen into this trap but I thought it was worth mentioning.

Read Temperature Once Per Minute

```
Line   Code     Label    Instruction          Comment

0100   A581     TKTEMP   LDA  SEC             Do At 50TH Second
0102   29FC              AND  FC
0104   C950              CMP  #$50
0106   F001              BEQ  DO
0108   60                RTS
0109   208001   DO       JSR  FREQ            Read Frequency At PB1
010C   A581              LDA  SEC
010E   29FC              AND  FC              Capture For 4 Seconds
0110   C950              CMP  #$50
0112   F0F5              BEQ  DO
0114   F8                SED                  Work In Decimal
0115   38                SEC
0116   A5F9              LDA  INH             Get LSB's Of Frequency
0118   8596              STA  CFREQL          Put In Current Frequency
011A   E594              SBC  LCAL            Subtract Calibration
011C   8589              STA  CTEMPL          Put In Current Temperature
011E   A5FA              LDA  POINTL          Repeat For MSB'S
0120   8597              STA  CFREQH
0122   E595              SBC  HCAL
0124   858A              STA  CTEMPH
0126   B00F              BCS  POS             Exit If Result Is Positive
0128   A900              LDA  #$00            Complement If Negative
012A   38                SEC
012B   E589              SBC  CTEMPL
012D   8589              STA  CTEMPL
012F   A900              LDA  #$00
0131   E58A              SBC  CTEMPH
0133   09C0              ORA  #$C0            And Put CX In CTEMPH
0135   858A              STA  CTEMPH
0137   D8       POS      CLD                  Go Back To HEX
0138   60                RTS                  Exit
```

Additional Zero Page Locations

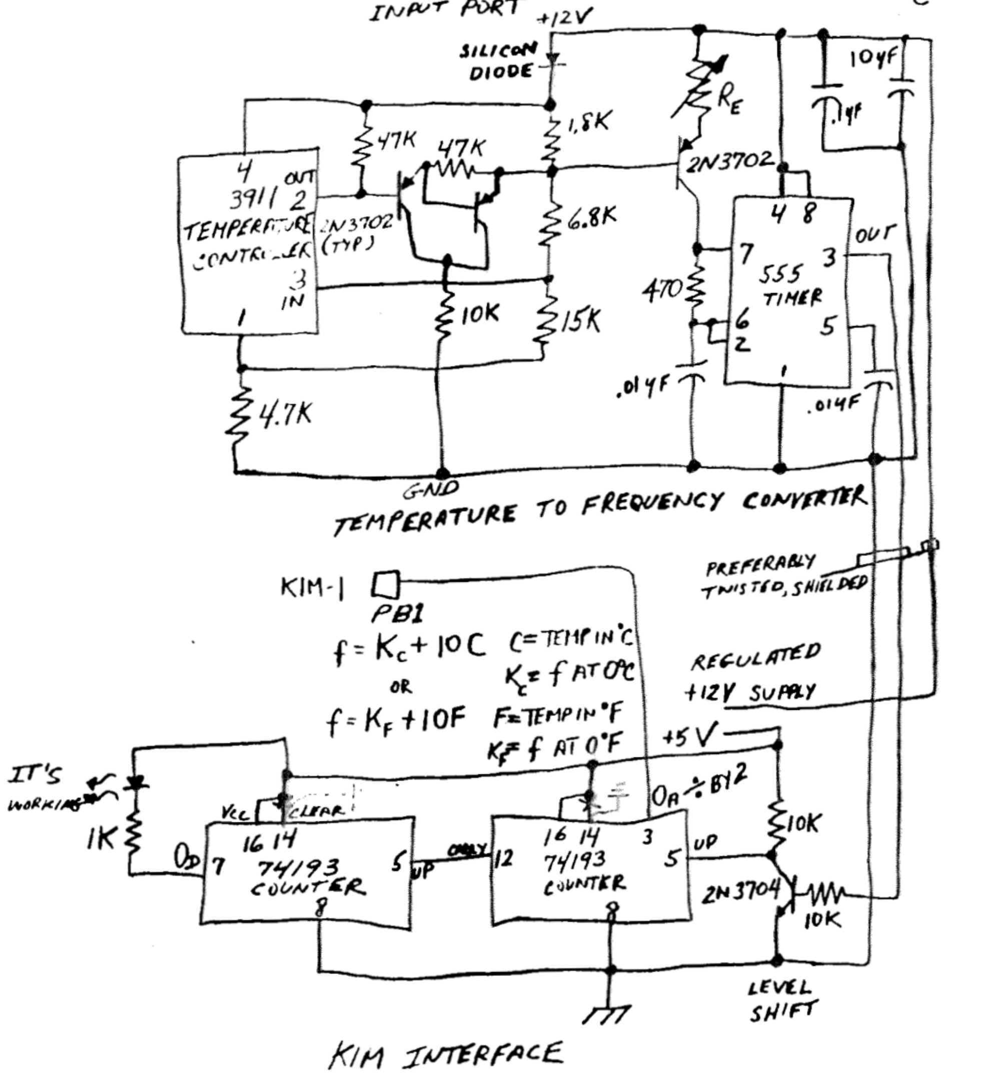
```
0089            CTEMPL                        LSB'S Of Current Temperature
008A            CTEMPH                        MSB'S Of Current Temperature
0094            LCAL                          LSB'S Of Calibration Constant
0095            HCAL                          MSB'S Of Calibration Constant
0096            CFREQL                        LSB'S Of Current Frequency
0097            CFREQH                        MSB'S Of Current Frequency
```

This is a subroutine which when added to the clock display routine will read the input port PB1 exery minute at the 50TH second and subtract the calibration constant in zero page locations The calibration constant is the frequency at zero degree's.

ADJUST VALUE OF R_E FOR Δf/° AT KIM INPUT PORT

$R_E \approx$ 10K FOR 10Hz/°F

$R_E \approx$ 18K FOR 10 Hz/°C



TEMPERATURE TO FREQUENCY CONVERTER

$f = K_C + 10C$ C=TEMP IN °C K_C= f AT 0°C

OR

$f = K_F + 10F$ F=TEMP IN °F K_F= f AT 0°F

KIM INTERFACE

C.H. PARSONS 3-20-77

Twentyfour Hour Conversion

```
Line Code   Label  Instruction      Comment
1780 A582   HRA    LDA MIN         Do On The Hour
1782 D017          BNE OUTN
1784 A483          LDY HR          If Hour Is 12
1786 C012          CMP #$12        Set To Zero
1788 D002          BNE N
178A A000          LDY #$00
178C A584   N      LDA DAY         If Afternoon
178E 2901          AND #$01        Add 12
1790 F006          BEQ OK
1792 F8            SED
1793 18            CLC
1794 98            TYA
1795 6912          ADC #$12
1797 A8            TAY             Put In 24 Hour
1798 8498   OK     STY ALTHR       Counter
179A D8            CLD
179B 60     OUTN   RTS
```

Additional Zero Page Locations

```
0098        ALTHR                  24 Hour Counter
```

This is a subroutine which generates a 24 hour clock. This is more convenient for control applications. This program could be incorporated in the clock interrupt routine if it were rewritten.

Display Current Temperature While 2 On KIM Is Pressed

```
Line    Code      Label     Instruction         Comment

0140    206A1F    DSTEMP    JSR GETKEY          Do When 2 Is Pressed
0143    C902                CMP #$02
0145    D02D                BNE RTS1
0147    A97F                LDA #$7F            Set Output Ports
0149    8D4117              STA PADD
014C    A20D                LDX #$0D            Initial Digit Number
014E    A002                LDY #$02            Output Two Bytes
0150    A589                LDA CTEMPL          Output Absolute Value Of
0152    85F9                STA INH             Temperature
0154    A58A                LDA CTEMPH
0156    293F                AND #$3F            Mask Sign
0158    85FA                STA POINTL
015A    20281F              JSR SCANDI          Display Temperature
015D    A58A                LDA CTEMPH
015F    29C0                AND #$C0            Minus?
0161    F00A                BEQ PLUS
0163    A07F                LDY #$7F            If So Superimpose Minus Sign
0165    8C4117              STY PADD            Set Input Ports
0168    A20B                LDX #$0B
016A    204E1F              JSR CONVD +6
016D    A900      PLUS      LDA #$00            Set Input Ports
016F    8D4117              STA PADD
0172    F0CC                BEQ DSTEMP          Do Again
0174    60        RTS1      RTS
```

This is a subroutine which when added to the clock display routine will display the current temperature on the KIM-1 display while 2 on the KIM-1 keyboard is depressed.

Temperature Control

```
Line Code    Label  Instruction    Comment

00B0 A581    CNTRLT LDA SEC        Do On The Minute
00B2 D033           BNE OUTZ
00B4 A000           LDY #$00       Get Temperature
00B6 A69A           LDX TEMP
00B8 A58A           LDA CTEMPH
00BA 29C0           AND #$C0       If Minus Set To
00BC F002           BEQ ARND       Zero
00BE A200           LDX #$00
00C0 A598    ARND   LDA ALTHR      Select Day Or Night
00C2 C59F           CMP DAYST      Table Of Set Points
00C4 9004           BCC NITE
00C6 C5A0           CMP DAYEND
00C8 9002           BCC BGN
00CA A00A    NITE   LDY #$0A
00CC 8A      BGN    TXA
00CD A200           LDX #$00
00CF D19B    LP     CMP (TAB1),Y
00D1 D00B           BCC OUTP       If Temperature Proceeds
00D3 C8             INY            Set Point,Output
00D4 E8             INX            Proper Control Code
00D5 E00A           CPX #$0A       If Not Keep Looking
00D7 D0F6           BNE LP         Through Table To
00D9 A9FF    OUTP   LDA #$FF       To The End
00DB 8D0117         STA PADD
00DE 8A             TXA
00DF A8             TAY
00E0 B19D           LDA (TAB2),Y
00E2 8D0017         STA PAD        PA-0 Thru PA-7 Are
00E5 85A1           STA COUT       Output Ports
00E7 60      OUTZ   RTS
```

Tables

```
17C1         TAB1                  Temperature Set
----                               Points TD1-TDA
17CA
17CB                               Temperature Set
----                               Points TN1-TNA
17D4
17D5         TAB2                  Control Codes
----
17DF
```

Temperature Control (continued)

Additional Zero Page Locations

```
Line Code   Label  Instruction     Comment

009B C1                            Temperature Table
009C 17                            Pointers
009D D5                            Control Table
009E 17                            Pointers
009F        DAYST                  Start Of Day Table
00A0        DAYEND                 End Of Day Table
00A1        COUT                   Current Control Code
```

This is a subroutine which puts a word at an output port which is determined by set points in a table. Refer to the work sheet for details.

Work Sheet For Temperature Control

		Alarm		Heat		Vent		Fan		Code
		on	off	on	off	on	off	on	off	
Output Port		PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0	
Temperature Range	Boundary Day Nite									
	<TD1<TN1									
1	Too Cld	1	0	1	0	0	1	0	1	A5
	TD1 TN1									
2	Hyst.	0	0	1	0	0	1	0	1	25
	TD2 TN2									
3	Cold	0	1	1	0	0	1	0	1	65
	TD3 TN3									
4	Hyst.	0	1	0	0	0	1	0	1	45
	TD4 TN4									
5	Normal	0	1	0	1	0	1	0	1	55
	TD5 TN5									
6	Hyst.	0	1	0	1	0	0	0	1	51
	TD6 TN6									
7	Warm	0	1	0	1	1	0	0	1	59
	TD7 TN7									
8	Hyst.	0	1	0	1	1	0	0	0	58
	TD8 TN8									
9	Warmer	0	1	0	1	1	0	1	0	5A
	TD9 TN9									
10	Hyst.	0	0	0	1	1	0	1	0	1A
	TDA TNA									
11	Too Hot	1	0	0	1	1	0	1	0	9A
	>TDA >TNA									

This is an example of a simple temperature control using four devices hooked to an eight bit output port. TD1-TDA & TN1-TNA represent the maximum temperatures in each temperature range. They are located in a table.

The lines labeled Hyst. are interposed between lines where action is taken to provide hysteresis between the on and off points of a device. They may not be necessary in a slow system but might be desirable in a fast system with tight control.

The code shown represents the proper word to place at the output port for proper control in any temperature range.

Each pair of outputs would be connected to a flip-flop for control of the respective devices.

Pack Temperature into 1 Byte Of Hybrid Code

```
Line Code    Label  Instruction       Comment

179C A581    PKTEMP LDA  SEC          Do On The Minute
179E D020           BNE  OUTF
17A0 A589           LDA  CTEMPL       Divide By Ten
17A2 4A             LSR
17A3 4A             LSR
17A4 4A             LSR
17A5 4A             LSR
17A6 859A           STA  TEMP
17A8 A58A           LDA  CTEMPH       Use FF for overflow
17AA C916           CMP  #$16         At 160 Degrees
17AC 9004           BCC  #$04
17AE A9FF           LDA  #$FF
17B0 859A           STA  TEMP
17B2 18             CLC               Multiply CTEMPH
17B3 0A             ASL               By Ten
17B4 0A             ASL
17B5 0A             ASL
17B6 0A             ASL
17B7 9003           BCC  SKIP         Test For Over 100
17B9 18             CLC               If So Convert MSB'S
17BA 69A0           ADC  #$A0         To Hexadecimal
17BC 059A    SKIP   ORA  TEMP         And Combine ½ Bytes
17BE 859A           STA  TEMP
17C0 60      OUTF   RTS
```

Additional Zero Page Locations

```
009A         TEMP                     Compressed Temperature
```

Although the temperature given by CTEMP is completely general it requires two bytes to describe. In order to reduce this to one byte and still provide a quasi-understandable code a hybrid notation was chosen. This code is limited to 0-159 degrees. The four LSB'S are retained in decimal notation and the four MSB'S are converted to hexadecimal.

ex. D6=136 degrees

Below 100 the temperatures can be read as decimal.

Frequency Counter Subroutine

```
Line Code    Label  Instruction       Comment

0180 A901    FREQ   LDA  #$01         Set I/O Ports
0182 8D0317         STA  PBDD
0185 A581           LDA  SEC          Do For 4 Seconds
0187 A8             TAY
0188 2903           AND  #$03
018A F038           BEQ  BACK
018C 98             TYA
018D 2902           AND  #$02         Display For Seconds
018F D030           BNE  DSPL         3&4
0191 A900           LDA  #$00         Zero Frequency Counter
0193 85F9           STA  INH          And Count For Second 2
0195 85FA           STA  POINTL
0197 85FB           STA  POINTH
0199 F8             SED
019A AD0217  L      LDA  PBD          Stall For One Pulse
019D 2902           AND  #$02
019F D0F9           BNE  L
01A1 AD0217  H      LDA  PBD
01A4 2902           AND  #$02
01A6 F0F9           BEQ  H
01A8 18             CLC               Count One Pulse
01A9 A901           LDA  #$01
01AB 65F9           ADC  INH
01AD 85F9           STA  INH
01AF A900           LDA  #$00
01B1 65FA           ADC  POINTL
01B3 85FA           STA  PIONTL
01B5 A900           LDA  #$00
01B7 65FB           ADC  PIONTH
01B9 85FB           STA  POINTH
01BB A581           LDA  SEC          Still Second 2?
01BD 2901           AND  #$01
01BF D0D9           BNE  L            If So Keep Counting
01C1 201F1F  DSPL   JSR  SCANDS       Display Count
01C4 60      BACK   RTS
01C5 200003  RFREQ  JSR  KIM          Start Here To Update
01C8 208001         JSR  FREQ         Every 4 Seconds
01CB 18             CLC
01CC 90F7           BCC  RFREQ        Loop
```

This is a subroutine which can be run by itself by entering at 01C5 or under program control with JSR FREQ. The output is the frequency at PB1 in Hertz.

end

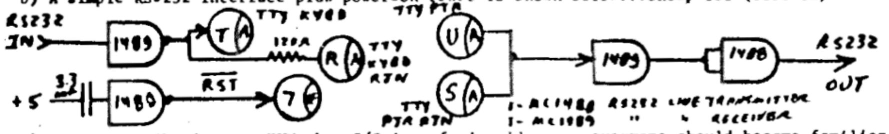
A KIM BINARY DUMP + LOAD ROUTINE FROM..

John Oliver
Associate Professor
of Astronomy
Williamson Hall
University of Florida
Gainesville FL 32611

Well, I guess the time has come to stop enjoying the good stuff others have sent in and to start contributing myself. The enclosed program was written for SPICA (Small Portable Interactive Computer for Astronomy) to allow dumping and loading blocks of data (or code) under program control. I have put in lots of comments and it should be almost self explainatory. The user defines a buffer area and dumps or loads that area at a rate of about 1000 bytes in 12 seconds. If an incoming file exceeds the buffer length reading stops when the buffer is filled and an error flag is set. If the incoming file ID does not match the requested ID the buffer is filled and an error flag is set. We have a relay on one output line connected to the REMOTE jack on the recorder to start and stop the tape. (Soon we hope to use a PHIDEC recorder for better control.) I use as much of the KIM ROM as possible but I wish they had used more subroutines in there, its not as nice as it could have been. With these subroutines a $29 cassette recorder can become a usefal digital data recorder at resonably high data rates (100 bytes per second + housekeeping).

Other Misc. Comments: a) We have used SUPERTAPE and SUPERDUMP/LOAD on a Radio Shack CTR-29 and a Radio Shack Minisette-V (very nice because of the CUE feature) with few problems. With the Minisette-V we need to unplug the earphone when recording to get sucess- I have not good reason why ???? But othersmight watch out.

b) A simple RS-232 interface plus power-on reset is shown below...cheap too (sort of).



c) Many contributions to KUN show I/O interfacing ideas....everyone should become familiar with the Motorola 68XX line of support chips (get their good data book). A major virtue of the 6502 is that it is compatible with all that good Motorola stuff....ignore M's instructions to gete the addressing with VMA since address is always valid with the 6502. I have used the 6820 (PIA: 16 I/O lines plus 4 handshaking control lines) and the 6850 (ACIA: good for interface to a terminal or a large computer terminal port. They are coming out with floppy disk and tape recorder support chips soon.....I couldn't wait and am using a NEC floppy controller meant for an 8080 (ugh) but wish I had waited.

d) My 9 year old, Jennifer Anne Oliver, loves WUMPUS and thanks you for publishing it..She runs KIM like a pro, they sure learn young.

```
;.************* SUPERDUMP/SUPERLOAD BY JOHN P. OLIVER ************
;                 DEPARTMENT OF PHYSICS AND ASTRONOMY
;                UNIVERSITY OF FLORIDA .GAINESVILLE FL
;
;     THIS PROGRAM ALLOWS THE USE OF THE KIM-1 CASSETTE TAPE
;   INTERFACE TO READ AND WRITE DATA BLOCKS UNDER PROGRAM CONTROL.
;   IT IS DERIVED FROM JIM BUTTERFIELD'S SUPERTAPE ROUTINES IN
;   KIM USERS NOTES #2 BUT EACH DATA BYTE IS WRITTEN AS AN 8-BIT
;   CHARACTER RATHER THAN AS TWO ASCII CODED HEX CHARACTERS.  THUS
;   1K BYTES ARE DUMPED OR LOADED IN LESS THAN 12 SECONDS.  THE
;   TAPE FORMAT HAS BEEN SOMEWHAT CHANGED IN THAT THE NUMEBER
;   OF BYTES IN THE RECORD ARE WRITTEN IN PLACE OF SAL/H. KIM ROM
;   ROUTINES ARE USED AS FAR AS POSSIBLE WHILE KEEPING FULL
;   SUBROUTINE STATUS FOR THESE PROGRAMS.
;
;   TO WRITE A FILE:   PUT STARTING ADDRESS IN $17F5/6
;                      PUT ENDING ADDRESS + 1 IN $17F7/8
;                      PUT FILE ID IN $17F9
;
;   THEN JSR SUPERD.  THIS ROUTINE CAN BE INTERRUPTED AS LONG
;   AS THE INTERRUPT ROUTINES DO NOT TOTAL MORE THAN 100
;   MICROSECONDS IN EACH 200 MICROSECONDS.
;
;   TO READ A FILE:    PUT INPUT BUFFER ADDRESS IN $17F5/6
;                      PUT END OF BUFFER + 1 IN $17F7/8
;                      PUT DESIRED FILE ID IN $17F9 (USE $00 TO GET
;                      NEXT FILE, REGARDLESS OF ITS ID ON TAPE)
;
;   THEN JSR SUPERL.  THE PROGRAM WILL RETURN WITH THE DATA IN
;   THE BUFFER AREA.THE RECEIVED ID IN $17F9, AND A FLAG ($00CB):
;                       = 00                LOAD OK
;                       = FF OR = 7F        BUFFER OVERRUN
;                       = FE OR = 7E        CHECKSUM ERROR
;
;   A FILE ID ERROR YIELDS 80, 7F, OR 7E.
;
;   THE LOAD ROUTINE IS RELOCATABLE. TO RELOCATE THE DUMP ROUTINE
;   MODIFY THE JSR'S TO  OUTCHT, OUTCHC, OUTBT, AND HEXTA.
;
;   ANY TAPE RECORDER CONTROL ROUTINES CAN BE CALLED BEFORE SUPERL
;   OR SUPERD.
;
;   NOTE: SUPERL WILL NOT RETURN TO THE CALLING ROUTINE IF THE TAPE
;   IS NOT READING PROPERLY.
```

```
00C8                           ORG   $00C8
00C8   00         DESID        FCB   0         ;INTENDED INPUT ID
00C9   00         EALB         FCB   0         ;BUFFER END ADDRESS
00CA   00         EAHB         FCB   0
00CB   00         LFLG         FCB   0         ;LOAD FLAG WORD
00CC   00         GANG         FCB   0
00CD   00         TIC          FCB   0
00CE   00         COUNT        FCB   0
00CF   00         TRIB         FCB   0
00D0   02         NPUL         FCB   02
00D1   C3         TIMG         FCB   $C3
00D2   03                      FCB   $03
00D3   7E                      FCB   $7E
0100                           ORG   $0100     ;SUPERDUMP STARTS AT $0100
0100   A9 AD      SUPERD       LDA   #$AD      ;'STA' OP CODE FOR VEB
0102   8D EC17                 STA   VEB
0105   20 3219                 JSR   INTVEB    ;INITIALIZE VEB
0108   A9 27                   LDA   #$27
010A   85 CC                   STA   GANG      ;SBD OUTPUT WORD
010C   A9 BF                   LDA   #$BF      ;OPEN CHANNELS
010E   8D 4317                 STA   PBDD
0111   A9 20                   LDA   #$20      ;SEND 32 SYNC CHARACTERS
0113   85 CD                   STA   TIC       ;SAVE CHAR COUNT
0115   A9 16                   LDA   #$16      ;....SYNC ....
0117   48         HICI         PHA             ;SAVE CHARACTER
0118   20 9001                 JSR   OUTCHT
011B   68                      PLA             ;RESTORE CHARACTER
011C   C6 CD                   DEC   TIC       ;REDUCE COUNTER
011E   D0 F7                   BNE   HICI      ;FINISHED?
0120   A9 2A                   LDA   #$2A      ;SEND '*'
0122   20 9001                 JSR   OUTCHT
0125   A9 00                   LDA   #$00
0127   20 6E01                 JSR   OUTBT
012A   38                      SEC             ;COMPUTE # OF BYTES ....
012B   AD F717                 LDA   EAL       ;.... TO BE SENT ....
012E   ED F517                 SBC   SAL       ;....SAVE NBL ....
0131   48                      PHA             ;....TEMP ON STACK
0132   AD F817                 LDA   EAH
0135   ED F617                 SBC   SAH
0138   20 6E01                 JSR   OUTBT     ;OUTPUT NBH
013B   68                      PLA             ;GET NBL AND ....
013C   20 6E01                 JSR   OUTBT     ;....OUTPUT
013F   AD F917                 LDA   ID        ;SEND....
0142   20 6E01                 JSR   OUTBT     ;....ID
0145   20 EC17    SUPUPI       JSR   VEB       ;GET BYTE USING VEB ....
0148   20 8D01                 JSR   OUTCHC    ;....AND SEND IT
014B   20 EA19                 JSR   INCVEB    ;INCREMENT FOR NEXT BYTE
014E   AD ED17                 LDA   VEB+1     ;ARE WE AT ....
0151   CD F717                 CMP   EAL       ;.... END ADDRESS?
0154   AD EE17                 LDA   VEB+2
0157   ED F817                 SBC   EAH
015A   90 E9                   BCC   SUPUPI    ;NOT FINISHED.GET MORE
015C   A9 2F                   LDA   #$2F      ;SEND '/'
015E   20 9001                 JSR   OUTCHT
0161   AD E717                 LDA   CHKL
0164   20 6E01                 JSR   OUTBT     ;SEND CHECKSUM
0167   AD E817                 LDA   CHKH
016A   20 6E01                 JSR   OUTBT
016D   60                      RTS
016E   48         OUTBT        PHA             ;HEX OUTPUT ROUTINE;SAVE BYTE
016F   4A                      LSR
0170   4A                      LSR
0171   4A                      LSR
0172   4A                      LSR
0173   20 8101                 JSR   HEXTA     ;GET 4 MSB AS ASCII
0176   20 9001                 JSR   OUTCHT    ;WRITE IT
0179   68                      PLA             ;RESTORE BYTE
017A   20 8101                 JSR   HEXTA     ;GET 4 LSB AS ASCII
017D   20 9001                 JSR   OUTCHT    ;WRITE IT
0180   60                      RTS
0181   29 0F      HEXTA        AND   #$0F      ;MASK OFF 4 LSB
0183   C9 0A                   CMP   #$0A
0185   18                      CLC
0186   30 02                   BMI   HEXTA1
0188   69 07                   ADC   #$07      ;A TO F
018A   69 30      HEXTA1       ADC   #$30      ;0 TO 9
018C   60                      RTS
018D   20 4C19    OUTCHC       JSR   CHKT      ;CHECKSUM CALCULATION
0190   A0 08      OUTCHT       LDY   #$08      ;SET FOR 8BITS
0192   84 CE                   STY   COUNT     ;SAVEBIT COUNT
0194   A0 02      TRY          LDY   #$02      ;SET FOR 3PHASES
0196   84 CF                   STY   TRIB      ;SAVEPHASE COUNT
0198   B6 D0      ZON          LDX   NPUL,Y    ;# OF 1/2 CYCLES
019A   48                      PHA             ;SAVE CHARACTER
019B   78         ZON1         SEI             ;DISABLE INTERRUPTS
019C   2C 4717    ZON2         BIT   CLKRDI    ;TIMER DONE?
019F   10 FB                   BPL   ZON2      ;NO,WAIT
01A1   B9 D100                 LDA   TIMG,Y    ;GET WAIT TIME IN MICRO ....
01A4   8D 4417                 STA   CLKIT     ;....SECONDS FOR TIMER
01A7   A5 CC                   LDA   GANG      ;FLIP OUTPUTBIT ....
01A9   49 80                   EOR   #$80      ;.... BETWEEN 0AND 1
01AB   8D 4217                 STA   SBD       ;OUTPUTBIT
01AE   58                      CLI             ;ENABLE INTERRUPTS
01AF   85 CC                   STA   GANG      ;SAVE OUTPUTBIT
01B1   CA                      DEX             ;ALL CYCLES SENT?
01B2   D0 E7                   BNE   ZON1      ;NO.SEND MORE
01B4   68                      PLA             ;RESTORE CHARACTER
```

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01B5  C6 CF              DEC   TRIB     ;ONE LESSPHASE TO GO
01B7  F0 05              BEQ   SETZ     ;AND THIS ISPHASE 3
01B9  30 07              BMI   ROUT     ;ALLPHASES DONE

01BB  4A                 LSR            ;GETBIT ....
01BC  90 DA              BCC   ZON      ;.... IF IT IS '1' ....
01BE  A0 C0      SETZ    LDY   #$C0     ;.... CHANGE TO 2400 HZ
01C0  F0 D6              BEQ   ZON      ;FORCED BRANCH
01C2  C6 CE      ROUT    DEC   COUNT    ;ONE LESSBIT TO GO
01C4  D0 CC              BNE   TRY
01C6  60                 RTS            ;ALL DONE
0200                     ORG   $0200    ;SUPERLOAD STARTS AT $0200
0200  AD F917    SUPERL  LDA   ID       ;STORE....
0203  85 C8              STA   DESID    ;....INTENDED ID
0205  AD F717            LDA   EAL      ;STORE BUFFER END ADDRESS
0208  85 C9              STA   EALB
020A  AD F817            LDA   EAH
020D  85 CA              STA   EAHB
020F  A9 00              LDA   #$00     ;INITIALIZE ....
0211  85 CB              STA   LFLG     ;.... LOAD ERROR FLAG
0213  8D F917            STA   ID       ;....AND ID FIELD
0216  A9 60              LDA   #$60     ;'RTS' OPCODE
0218  8D EC17            STA   VEB      ;RETURN OUT OF LOADT
021B  20 8C18            JSR   $188C    ;PUSH PATCH ADDRESS ONSTACK, GO TO LOADT
021E  8D F917    PATCH   STA   ID       ;WE GET HERE FROM $190C...JMP VEB
0221  C5 C8              CMP   DESID    ;INTENDED ID ?
0223  F0 0A              BEQ   PATCH2   ;YES
0225  A9 00              LDA   #$00     ;ANY ID ....
0227  C5 C8              CMP   DESID    ;.... OK?
0229  F0 04              BEQ   PATCH2   ;YES
022B  A9 80              LDA   #$80     ;SET ERROR FLAG ....
022D  85 CB              STA   LFLG     ; .... AND CONTINUE
022F  A9 8D      PATCH2  LDA   #$8D     ;'STA' OPCODE
0231  8D EC17            STA   VEB      ;RECREATE VEB STORE INST
0234  18                 CLC            ;CLEAR CARRY FOR ENDING ADD COMP
0235  AD EE17            LDA   VEB+2    ;GET # OF BYTES _ ....
0238  7D F517            ADC   SAL      ;.... ADD SAL ....
023B  8D F717            STA   EAL      ;.... TO GET EAL
023E  AD ED17            LDA   VEB+1    ;GET # OF BYTES 4 ....
0241  7D F617            ADC   SAH      ;.... ADD SAH ....
0244  8D F817            STA   EAH      ;.... TO GET EAH
0247  20 3219            JSR   INTVEB   ;CLEAR CHKSUM,SET UP VEB
024A  20 241A    PATCH1  JSR   RDCHT    ;GET NEXT BYTE (ACC HAS 7BIT ASCII) ....
024D  AD EA17            LDA   SAVX+1   ;.... SO GET THE FULL 8BIT BYTE
0250  20 4C19            JSR   CHKT     ;ADD TO CHECK SUM
0253  20 EC17            JSR   VEB      ;STORE IT
0256  20 EA19            JSR   INCVEB   ;INCREMENT VEB ADDRESS FOR STORE
0259  AD ED17            LDA   VEB+1    ;END ADDRESS?
025C  C5 C9              CMP   EALB     ;BUFFER END ?
025E  D0 02              BNE   PATCH3   ;NO
0260  F0 C5              BEQ   PATCH4   ;MAYBE ?
0262  CD F717    PATCH3  CMP   EAL      ;RECORD END?
0265  D0 E3              BNE   PATCH1   ;NO, GET MORE BYTES
0267  AD EE17    PATCH4  LDA   VEB+2
026A  C5 CA              CMP   EAHB     ;BUFFER END ?
026C  D0 0F              BNE   PATCH5   ;NO
026E  CD F817            CMP   EAH      ;ALSO RECORD END ?
0271  D0 28              BNE   ERROR2   ;NO, ERROR EXIT
0273  AD ED17            LDA   VEB+1    ;LOW ORDER BYTE ALSO OK?
0276  CD F717            CMP   EAL
0279  D0 20              BNE   ERROR2   ;NO, ERROR EXIT
027B  F0 05              BEQ   PATCH6
027D  CD F817    PATCH5  CMP   EAH      ;RECORD END ?
0280  D0 C8              BNE PATCH1     ;NO, CONTINUE
0282  20 241A    PATCH6  JSR   RDCHT    ;GET ENDING CHARACTER
0285  C9 2F              CMP   #$2F     ;'/'?
0287  D0 10              BNE   ERROR
0289  20 F319            JSR   RDBYT    ;GET CHECKSUM LO
028C  CD E717            CMP   CHKL     ;CHECKSUM OK?
028F  D0 C8              BNE   ERROR
0291  20 F319            JSR   RDBYT    ;GET CHECKSUM HI
0294  CD E817            CMP   CHKH     ;
0297  F0 04              BEQ   EXIT
0299  C6 CB      ERROR   DEC   LFLG     ;FE OR 7E = CHECKSUM ERROR
029B  C6 CB      ERROR2  DEC   LFLG     ;FF OR 7F = OVERRUN ERROR
                 ; 80, 7E OR 7F INDICATES ID ERROR
                         RTS            ;RETURN
```

KIMSI COMMENTS

From the response I've received concerning the KIM to S-100 bus adapter being offered by FORETHOUGHT PRODUCTS, I'd say there are a number of satisfied users. Nothing but words of praise for the product, so far. With S-100 memory running as low as $125 for 8K kits (BASE 2), the scheme seems like a reasonable method for system expansion. As far as assembled S-100 boards are concerned, the only ones that I am familiar with are the KENT-MOORE products. They market video and memory boards which seem to work as well as they look.

more

By the way, I've been informed that FORETHOUGH PRODUCTS have cleared up any problems with their telephone service and are now accepting VISA (BankAmericard). Their phone number is (503) 485-8575. They indicate off-the-shelf delivery.

BASE 2 INC, PO Box 9941, Marina del Ray, Ca 90291   (213) 822-4499

KENT-MOORE INSTRUMENT CO., PO Box 507, Industrial Ave, Pioneer, Oh 43554
(419) 737-2352

FORETHOUGHT PRODUCTS, PO Box 386, Coburg, Or., 97401

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RANDOM ACCESS CORNER

Here's a new feature of the NOTES for those who have special needs...

PEN PAL NEEDED - P. A. Ras, H. Gorterhof 138, DELFT, NETHERLANDS
Mr. Ras also needs info on Friden Flexowriter/KIM interfacing.

BURROUGHS TERMINAL/KIM-1 INTERFACE info needed by Gene Moore, 817 Windsor Rd
Cumberland, Md.21502

BRINGING UP 8K OSI BASIC ON KIM? or trying to bring it up?...get in touch with
Donald Hill, 60 Evans Ave., East Hartford, Ct. 06118

FORTRAN II FOR THE 6502---"We're thinking about offering it depending on interest. Send SASE and info on what software you need to GENESEE MICROCOMPUTERS, 29 Genesee St., Piffard NY 14533"

GERMAN USER GROUP GETTING STARTED in the Frankfurt area. For more info, contact Erich Scheiber, Berliner St. 10, 6236 Eschborn,
West Germany.

KIM-3 and/or KIM-4 desperately needed!!! contact JOHNSON COMPUTER
(216) 725-4560

WASHINGTON AREA KIM ENTHUSIASTS who are interested in starting a KIM KLUB, send a S.A.S.E. or call!!! WAKE c/o Ted Beach, 5112
Williamsburg Blvd, Arlington, Va 22207   (703) 538-2303

MICRO-SOFTWARE SPECIALISTS INC., 1911 Meadow Lane, Arlington, Tx 76010 have announced that they have cleared up the problems with their assembler mentioned in our newsletter. They are accepting VISA at (817) 274-0291

WANTED: KIM-2 or KIM-3 RAM board for memory expansion. Contact Kenneth W. Ensele, 1337 Foster Rd., Napa Ca 94558   (707) 226-5014

FOR SALE: KIM-1 and expermintation accessories used in TERC microprocessor workshops. Valued at $500.00, will sell for $300.00.
W. L. Sadler, 2020 Easy Street, Waukesha, Wi., 53186
(414) 547-9391

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BOOK REVIEW SECTION from Charles A. Mills, 677 Lippincott Ave.,
Moorestown, N.J. 08057

UNIQUE PROGRAMMING BOOK ••• HOW TO PROGRAM MICROCOMPUTERS by William Barden (SAMS $8.95) explains looping, stacks, list processing, bit manipulation, etc. The unique feature is that all program explanations are for the 8080, 6800, and 6502 so one can see how each is programmed to do the same thing. Twenty utility programs in each system are provided for comparison of coding requirements.

(Ive seen this book and can also recommend it.....ERIC)

continued from pg. 15

Simpson, Richard S., "A Date with KIM"
Byte 1, No. 9, pp. 8-12 (May 1976)
Description of the features of KIM-1.

Microcomputer Associates, 111 Main St., Los Altos, CA 94022
"Jolt Microcomputer"
Radio-Electronics 47, No. 6, p. 66 (June 1976)
Includes description of JOLT, based on 6502, and gives demonstration program using DEMON Monitor.

Travis, T. E., "KIM-1 Microcomputer Module"
Microtrek, pp. 7-16 (August 1976)
Notes and programs for KIM-1 including Drunk test and several useful routines.

Anon., "MOS Technology - KIM MCS 6502"
Interface Age 1, No. 9, pp. 12, 14 (August 1976)
An announcement of the KIM-1.

Rankin, Roy and Wozniak, Steve, "Floating Point Routines for the 6502"
Dr Dobbs Journal 1, No. 7, pp. 17-19 (August 1976)
Calculations from 10^{-38} to 10^{+38} with 7 significant digits.

Bradshaw, Jack, "Monitor for the 6502"
Dr Dobbs Journal 1, No. 7, pp. 20-21 (August 1976)
Monitor a la OSI.

Garetz, Mark, "Lunar Lander for the 6502"
Dr Dobbs Journal 1, No. 7, pp. 22-25 (August 1976)
A game requiring TIM Monitor and a terminal.

Gupta, Yogesh M., "True Confessions: How I Relate to KIM"
Byte 1, No. 12, pp. 44-48 (August 1976)
A series of notes on KIM-1. Includes Clock Stretch and Random Access Memories, Bus Expansion and modification of drive capability using tristate drivers, Interrupt Prioritizing Logic and Halt Instruction.

Thompson, Geo. L., "KIM on, Now"
Byte 1, No. 13, pp. 93-94 (September 1976)
Notes on using KIM-1.

Wozniak, Steve, "Mastermind: A Number Game for the 6502"
DDJ 1, No. 8, pp. 26-27 (September 1976)
A number game adaptable to KIM-1 with terminal.

Baum, Allen and Wozniak, Stephen, "A 6502 Dissembler"
Interface Age 1, No. 10, pp. 14-23 (September 1976)

Kjeldsen, Tony, "Next of KIM" (letter)
Byte 1, No. 14, p. 136 (October 1976)

Pittman, Tom, "Tiny Basic for 6502"
DDJ 1, No. 9, pp. 22-23 (October 1976)
Available from Itty Bitty Computers. TB650K (0200-0AFF) is for KIM and most homebrew 6502 systems with RAM in first 4K of memory.

Anon., "Build a Simple A to D"
Interface Age 1, No. 12, pp. 12-14 (November 1976)
Simple circuit, 6502 software, 16 locations. Use to interface a pot or a joystick.

Pollock, James W., "1000 WPM Morse Code Typer"
73 Mag. No. 196, pp. 100-103 (January 1977)
Use of KIM-1 for sending code at 9-1000 WPM from a keyboard.

Robbins, Carl M., "The Microprocessor and Repeater Control"
QST 61, No. 1, pp. 30-34 (January 1977)
KIM-1 control of repeater functions.

Cushman, Robert H., "Bare-bones Development Systems Make Good Learning Tools"
EDN 22, No. 6 (March 20, 1977)
See also 22, No. 8, pp. 104-111 (April 20, 1977)
22, No. 4, pp. 89-92 (February 20, 1977)
22, No. 10, pp. 84-90 (May 20, 1977)
22, No. 12, pp. 79-84 (June 20, 1977)
Use of KIM-1 in a music program is detailed in April 1977 issue.

Salter, Richard J. and Burham, Ralph W., "Navigation with Mini-0"
Byte 2, No. 4, pp. 100-109 (April 1977); See also Byte 2, No. 2, p. 62 (February 1977) and Byte 2, No. 3, p. 70 (March 1977).
Several articles in a series on the Omega Navigation System and the Mini-0 Receiver driven by a KIM-1 processor. Developed at the Ohio University Avionics Engineering Center.

Haas, Bob, "KIM-1 Memory Expansion"
Kilobaud, No. 4, pp. 74-76 (April 1977)
Adding the S.D. Sales 4K Low Power RAM board to KIM-1.

Gordon, H. T., "Stringout Mods"
DDJ 2, No. 2, p. 8 (February 1977)
A 6502 program applicable to KIM-1 to relocate blocks of instructions in RAMs.

Sherman, Ralph, "A 650X Program Relocater"
DDJ 2, No. 4, pp. 30-31 (April 1977)

Ockers, Stan, "TV Sketch Program"
DDJ 2, No. 4, pp. 32-33 (April 1977)
A program for use with KIM-1 equipped with a Southwest Tech Prod Co. Graphics Board GT 6144.

Simpson, Rick, "Come Fly with KIM"
Byte 2, No. 6, pp. 76-80 (June 1977)
Load 12K of memory in two minutes with a "Fly Reader" for paper tape.

Lancaster, Don, "A TVT for your KIM"
Kilobaud, No. 6, pp. 50-63 (June 1977)
TVT-6L is a low cost method of providing a TV monitor for KIM-1. Uses minimum new hardware but depends on a software program in KIM-1 memory for handling characters. Uses a low cost TV (Pansonic T-126A) for monitor.

Lancaster, Don, "Build the TVT-6"
Popular Electronics 12, No. 1, pp. 47-52
A low cost direct video display based on KIM-1 software and a minimum of added hardware. Slightly different than the TVT-6L.

Pickles and Trout, P.O. Box 2270, Goleta, CA 93018 "TV Mod Kit"
Detailed instructions and kit of parts for conversion of a low cost ($80 approx.) Hitachi SX Chassis (Model P-04, P-08, PA-8, etc.) for a TV Monitor.

Grater, Robert, "Giving KIM Some Fancy Jewels"
Byte 2, No. 7, pp. 126-127 (July 1977)
Adding a remote LED display for the KIM-1.

Runyan, Grant, "The Great TV to CRT Monitor Conversion"
Kilobaud, No. 7, pp. 30-31 (July 1977)
Although not specific to KIM-1, this article is useful in adapting a monitor to KIM. Uses inexpensive 12" Hitachi Model P-04, P-08, PA-4, PA-8. See also Sams Photofact Folder 1 Set 1601 or Folder 3 Set 1501.

Fish, Larry, "Troubleshoot Your Software"
Kilobaud, No. 8, pp. 112-113 (August 1977)
A trace program for 6502.

more next time...